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ENVIRONMENTAL STATEMENT

U. S. DEPARTMENT OF INTERIOR
OIL SHALE
ENVIRONMENTAL ADVISORY PANEL
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PROPOSED SUPERIOR OIL COMPANY LAND EXCHANGE AND OIL SHALE RESOURCE DEVELOPMENT

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OIL SHALE ENV. ADV. PANEL

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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COVER: *Aerial oblique photograph looking southward into the Piceance Creek Basin.*

LEGEND: **A.** *Mine Portal Area*
B. *Plant Site*
1. *Rio Blanco Lake*
2. *State Highway 64*
3. *Piceance Creek Road*
4. *Piceance Creek*
5. *White River*

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DRAFT
ENVIRONMENTAL STATEMENT

PROPOSED SUPERIOR OIL COMPANY LAND EXCHANGE AND OIL SHALE RESOURCE DEVELOPMENT

STATE DIRECTOR, COLORADO STATE OFFICE

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SUMMARY

(X) Draft ( ) Final Environmental Statement
Department of the Interior, Bureau of Land Management
1. *Type of Action:* (X) Administrative ( ) Legislative
2. *Brief Description of Action:* The Superior Oil Company requested an exchange of public land for private land. With the exchange, an economical mining unit would be formed and oil shale resources developed. Major federal actions would be the revoking of the oil shale withdrawal by the Secretary of the Interior and the exchange of land by BLM.
Following the exchange, Superior would construct an underground mine and a processing plant. The mine would produce an average of about 26,000 tons of oil shale daily. From the oil shale, the plant would produce about 4,800 tons of nahcolite, 11,500 barrels of shale oil, 580 tons of alumina, and 1,000 tons of soda ash daily. Production would continue for about 20 years. Above-ground facilities would occupy about 380 acres. Approximately 920 people would be employed during operation of the project. Products would be hauled from the plant by truck.
3. *Summary of Environmental Impacts:* Jobs would be created and the average income of the area increased. Other industries, such as agriculture, would be disrupted by the drawing away of employees to the new employments. Businesses would prosper and the costs of goods and services would be inflated. Overall, the quality of life would increase. However, those on fixed incomes and those unable to compete in business would have their quality of life decreased. Completion of the project and the migration of some of the people out of the area would depress the area.
Lifestyles would be further trended from an agricultural-type, or rural, to industrial. Only Rio Blanco County and the Meeker School District would collect sufficient revenues to cover costs of community services to the new population. Service levels would decline or taxation would increase in Garfield County, Rifle, Rangely, Meeker, and in the Rifle and Rangely School Districts.
Two ranching operations would be impacted by reducing net revenues. Either the ranchers would be forced from business or the operation would be further subsidized.
Highway usage would expand. Maintenance costs would be higher. Congestion would increase as would safety hazards, noise levels, and deer-vehicle collisions.
Water quality in Piceance Creek and the White River would be increased by the removal of salt during operation of the project. The quality of other valued elements of the environment, such as air quality, would decline.
4. *Alternatives Considered:*
   A. No Action
   B. Product Transportation
      1. Railroad
      2. Pipeline
   C. Expanded Resource Development
5. *Request for Comments:* See the list contained in Chapter 9--Consultation and Coordination.

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CHAPTER 1

DESCRIPTION OF THE PROPOSAL

BACKGROUND

The Superior Oil Company (Superior) began work in 1967 to determine the feasibility of a multi-mineral recovery process using oil shale containing the minerals nahcolite and dawsonite. To establish the geology of the proposed project site and the resource quantity, 46 core holes were drilled. Based on data from the cores, which are cylindrical samples of rock from the drill, the proposed mine was planned.

The design and operation of the proposed processing units are based on development work that Superior carried out. Prototype processing units were constructed and operated; a 250 tons-per-day capacity oil recovery unit, or retort; a 4,800 pounds-per-day soda ash and alumina plant; and, a full scale nahcolite separation unit. Successful testing was also carried out using nahcolite for scrubbing, or removing, impurities from gas emitted from power plants (*Electric Power Research Institute, 1976*).

In 1973, Superior requested that the Department of the Interior exchange public lands administered by the Bureau of Land Management (BLM) for private lands. The exchange is being considered under the authority of Section 206 of the Federal Land Policy and Management Act of 1976 (FLPMA), Public Law 94-579.

This Environmental Statement (ES) has been prepared in compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190. It analyzes impacts of, and alternatives to, the proposed exchange and resulting oil shale resource development by Superior. The development, or project site, would be located in northwest Colorado, Rio Blanco County (Map 1-1).

PURPOSE AND OBJECTIVES

Superior has proposed a land exchange to create an economically feasible mining operation. Present ownership patterns would result in excessive cost associated with mining about 8 miles of adit, which is a passageway or entrance from the surface to a mine, providing ventilation, movement of ore, and other distance-related factors. The proposed land exchange would create a compact mining unit.

At full production, Superior would mine about 26,176 tons per day of oil shale containing the minerals nahcolite and dawsonite. Nahcolite, a naturally occurring sodium bicarbonate ($NaHCO_3$) would be mechanically separated from the oil shale. From the dawsonite ($NaAl(OH)_2CO_3$), alumina (Al_2O_3) and soda ash (Na_2CO_3) would be produced. Table 1-1 contains a summary of the proposed production.

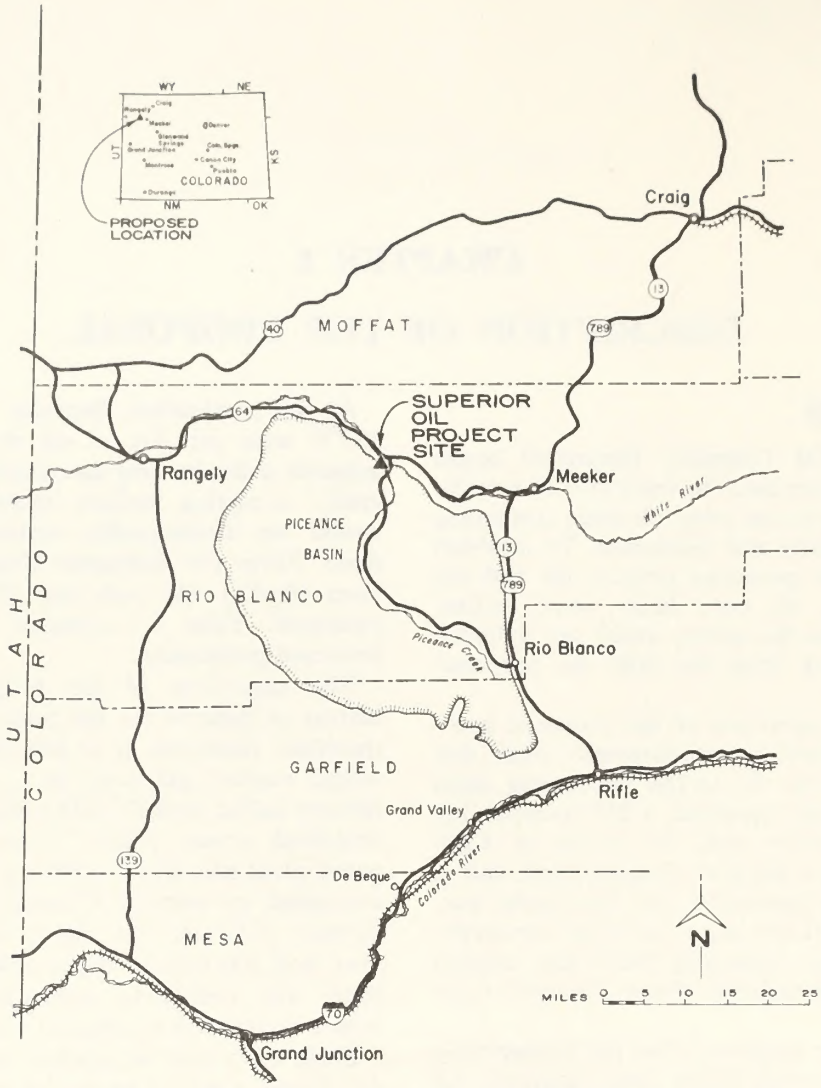
The objectives of the project, defined as a market or demand for the products, have not been specified. However, it is anticipated that Superior would market nahcolite as a scrubbing agent to remove sulfur dioxide (SO_2) from the emissions of coal-fired power plants. Trucked from the proposed plant site, about 1,200 tons per day would be consumed in western Colorado; 600 tons in the vicinity of Craig, 300 tons in the Grand Junction area, and 300 tons in the southwestern part of the state. The remaining, approximately 3,600 tons, would be trucked to adjacent states.

Shale oil would be trucked to Rangely, Colorado. There, it would be stored in existing tanks and transported, using existing pipelines, to presently operating refineries in Utah and Wyoming.

The alumina and soda ash would be trucked to Rifle for rail shipment to the northwest and southeast United States. Alumina would be marketed for the production of aluminum. Approximately 50 percent of the soda ash would be marketed for manufacturing glass, 25 percent for making paper, and 25 percent for use in the chemical industry.

AUTHORIZING ACTIONS

This section identifies permissions Superior would obtain from government agencies before the proposed project would be implemented. The discussion is limited to those actions having the effect of allowing the project to proceed as proposed or not. In addition to these crucial permits, Superior must obtain several other approvals and certifications and meet specific requirements and standards. The reference documents for this section (*Cameron Engineers, 1978 and 1979, Colorado Office of the Governor, 1977, and the U.S. Department of Energy, 1978*) describe these other authorizations along



LOCATION MAP OF THE PROPOSED SUPERIOR OIL PROJECT

MAP 1-1

Product	Assumed Timetable	Average Daily Production	Total Project Production
Nahcolite	1983 to 2006 (23 yrs)	4,878 tons	40,290,000 tons
Shale Oil	1987 to 2006 (20 yrs)	11,586 barrels	84,578,000 barrels
Alumina	1987 tp 2006 (20 yrs)	580 tons	4,234,000 tons
Soda Ash	1987 to 2006 (20 yrs)	1,005 tons	7,337,000 tons

Note:
Production is based on one calendar year = 365 days.
The average daily production rate shown for nahcolite would be during the full-scale production period.
A barrel is equivalent to 42 U.S. gallons.

SUMMARY OF PRODUCTION FROM THE PROPOSED SUPERIOR OIL PROJECT

TABLE 1-1

with providing additional detail and procedures for all the permits.

Federal

Department of the Interior

SECRETARY OF THE INTERIOR

Would revoke, or modify, the withdrawal on the 2,045 acres of public land Superior would receive with the proposed exchange. This action would occur before BLM would make the exchange. Executive Order (EO) 5327, dated April 15, 1930, withdrew federal lands containing oil shale from lease and disposal, including exchanges. The revoking procedures, which include public notice, would conform to Section 204 of the Federal Land Policy and Management Act of 1976 (FLPMA).

BUREAU OF LAND MANAGEMENT (BLM)

The BLM would;

1. Give Superior title, or deed, to the approximately 2,045 acres of public land proposed in the exchange. The exchange would be processed in compliance with Section 206 of FLPMA which requires the public interest be well served and the values of the land parcels be equal or equalized by adjustment in acreage or cash payment by Superior.

2. Accept from Superior title to approximately 2,572 acres of private land. Superior owns the mineral rights, or mineral estate, on this acreage and would purchase the surface from the state of Colorado's Division of Wildlife (DOW). A mutually acceptable land appraiser would estimate land value. DOW purchased the land in the 1940s with money provided through the Federal Aid in Wildlife Restoration Act, which is administered by the U.S. Fish and Wildlife Service (FWS). Before DOW would sell the land, FWS must certify that replacement be made by an area of equal market value and equal value for fish and wildlife. If the replacement values are not equal, DOW would return the original funds to FWS at current dollar value.

Army, Corps of Engineers (COE)

Would issue a River and Stream Crossing Permit, commonly known as a 404 Permit, in accordance with Section 10 of the River and Harbor Act of 1899, Section 404 of Public Law 92-500 (P.L. 92-500), and Section 103 of P.L. 92-535. Superior would provide COE sketches and a detailed description of the work proposed to be done on the 230-foot culvert in Piceance Creek at the mine area and the 4,300-foot conduit through the shale and process water storage area. Approval would be given before Superior begins any work that would disturb the creek. COE would coordinate the analysis of Superior's application with the state, Environmental Protection Agency, and FWS, plus, give public notice.

Department of Energy (DOE)

In order to construct and operate the proposed steam plant, Superior would receive from DOE a Major Fuel Burning Installation Approval (MFBI). The procedures DOE would follow, as outlined in 10 Code of Federal Regulations 303-309, include Superior's filing of a MFBI "Early Planning Process Identification Report" for consideration.

Environmental Protection Agency (EPA)

Would issue a permit for Prevention of Significant Air Quality Deterioration (PSD) before project construction would begin. To enable EPA to determine whether or not to issue a permit, Superior would give EPA detailed emission data and actual monitored air quality information for its project area. EPA would then perform its own air quality analysis. Superior would also show that the Best Available Control Technology (BACT) would be used. Authority for the PSD permit is provided by Public Law 95-95, known as the Clean Air Act Amendments of 1977.

Federal Aviation Administration (FAA)

Would approve the construction of the 200-foot stack associated with the steam plant. In accordance with FAA Regulations, Part 77, the determination will be made regarding potential hazards of the tower to aviation.

State

Department of Health

COLORADO AIR POLLUTION CONTROL DIVISION

Would issue an Air Contaminate Emission Permit in compliance with the Colorado Air Pollution Control Act. The permit would be issued before construction would start. Superior's application would include equipment information, plans, and other descriptions necessary to determine if appropriate air pollution control regulations, ordinances, and air quality standards would be met. Public comment on the application would be sought.

WATER QUALITY CONTROL DIVISION

Would give Superior a Subsurface Disposal Permit for its mine backfill operation and reinjection wells. This permit would be issued under regulations contained in the Colorado Revised Statutes (CRS) 1963, 66-28-400 if no waters would be polluted or, if polluted, the pollution would be limited to an area from which there is no risk of significant

migration and the purpose is justified by public need. Public notice would be given to landowners within a two-mile radius of the disposal areas and a hearing would be held for those people.

Department of Natural Resources

COLORADO MINED LAND RECLAMATION BOARD (CMLRB)

Before construction of the mine would begin, the CMLRB would issue a Permit of Regular Mining Operations. Superior would submit, as part of its application, plans for mining and reclamation, soil, vegetation, water and wildlife information plus other details about the proposal. CMLRB would give the public an opportunity to review and comment on the application. The provision for this permit action is contained in the Colorado Mined Land Reclamation Act, 1976.

DIVISION OF WATER RESOURCES, STATE ENGINEER

The State Engineer would;

1. Approve, prior to construction, plans for the shale and process water storage area, specifically the proposed dike and water storage basin. Superior would submit plans and specifications, approved by a registered engineer, for analysis. These requirements are contained in CRS 148-5-5.

2. Issue permission for Water Well and Pump Installation in connection with the proposed reinjection wells. Considerations include permeability, distance from contaminates, draw-down characteristic, and other conditions of the aquifers. The county government would be consulted during the process, which is a result of CRS 1963 148-20-4(1) and 148-20-10(2).

Local

Rio Blanco County

Would give Superior a Special Use Permit allowing mining within the area presently zoned H-I, or Heavy Industrial. The legal citation for this action is contained in Rio Blanco County Ordinance 305.2. Superior would provide an impact analysis statement as part of its application. The statement would include a detailed mining plan and expected water, wildlife, revegetation actions, air, and waste problems, and, the solutions to these problems. A public hearing would also be held.

DESCRIPTION OF THE PROPOSED ACTION

Introduction

The federal action that would be involved in Superior's proposal would be an exchange of public land administered by BLM for private land. It is the request for modification of Secretarial withdraw under EO 5327 as a prerequisite to the land exchange proposal that initiated this ES. Following a land exchange, Superior would construct and operate a mine and plant to process oil shale.

The construction period would begin with preconstruction activities involving the preparation of engineering designs and acquisition of the necessary permits discussed in the preceding section, Authorizing Actions.

Auxiliary facilities, consisting of electrical, potable water, and sewage treatment systems, would be constructed to serve both the mine and plant areas. Service would begin following their construction and would continue throughout the life of the project.

Mine construction would start with a mine development phase when access to the underground area to be mined would be built. The work would include construction of road access to the mine portal area, driving an adit, which would be the underground passageway between the surface and the area to be mined, and installation of associated features such as structures, buildings, and pumping systems to handle water that would occur in the mine.

During the premining phase, access passageways would be driven in the mining zone itself and two additional adits would be built. Access provided by the three adits would allow the movement of personnel, oil shale, air, and equipment necessary for mining. A secondary access shaft would be drilled from the surface into the mine zone and serve as an emergency escape for the miners.

At the plant area, a shale and process water storage area would be built. Construction of this feature includes relocating an existing electrical transmission line, digging ditches around the area to intercept and divert runoff, placing a section of Piceance Creek in conduits, excavating a water storage basin, and construction of a dike to contain discharge from the area.

Plant support items that would be constructed include fencing, roadways, and a fire control system. Storage and piping facilities would be installed for liquified petroleum gas and natural gas, which would be used during initial operation of the plant. Conveyors and piping would be built to transport water and shale between the mine and plant.

A process water system would be installed at the plant to provide cooling water and steam to the processing units. To condition water used to leach the soda ash and alumina, a process water treatment plant would be built.

Three processing units would be erected. The nahcolite recovery unit would include a secondary

crusher and a storage dome. The oil recovery unit would remove, or retort, the shale oil and treat the shale for processing in the soda ash and alumina recovery units. Tanks and silos would be erected to hold the nahcolite, shale oil, soda ash, and alumina products until shipment.

With operation of the project, the oil shale would be crushed in the mine and conveyed to the secondary crushers at the plant area. From the secondary crushers the oil shale would be transported to the shale storage area for delivery to the processing units and ultimately back to the mine for backfilling. A general diagram of the flow of oil shale is shown on Figure 1-1B.

Water stored in the process water storage basin would be pumped to the process water system for use in the cooling water system and process water treatment plant (Figure 1-1A). The proposed steam plant is essentially a closed system requiring only nominal make up, or replenishment, water. Disposal of process wastes is shown in Figure 1-1C.

Abandonment would occur at the end of project operations. Facilities would be removed and the site reclaimed. Superior would return the majority of the disturbed area to agricultural uses.

As a basis for this ES, Superior has provided a detailed description of its proposal (*Superior Oil Company, 1978*). Included in this material are process flow diagrams which include materials and quality and quantity of emissions. The flow diagrams are available upon request to BLM. The description of the proposal that follows has been simplified to aid in the understanding of the project. To assist in this understanding, a project map (Map 1-2) and an assumed schedule (Figure 1-2) is contained in the packet attached to the inside back cover. The map and schedule should be referred to while reading the narrative. The project map locates and identifies the proposed project features, including the components of the land exchange. The assumed schedule lists the discrete actions of the proposal in the same sequence as the narrative. A general overall schedule for the primary components of the proposal, which are the land exchange, construction, operation, and abandonment, is shown on Figure 1-3.

Land Exchange

The surface and mineral estates on approximately 2,045 acres of public land administered by BLM would be exchanged for the surface and minerals on about 2,572 acres Superior would own. Superior currently owns the mineral rights on the 2,572 acres and would purchase the surface from the present owner, the state of Colorado's Division of Wildlife (DOW). In addition to the parcel involved in the proposed exchange, Superior would purchase another 400 acres of surface from DOW on which project facilities would be located.

Following the proposed exchange, BLM would manage the 2,572 acres for multi-purpose uses including livestock grazing and wildlife management. Except for approximately 45 acres required for project facilities, Superior would grant DOW a perpetual, or unlimited duration, surface easement for wildlife management purposes on the 2,045 acres it would receive in the exchange plus the additional 400 acres purchased. Current use would not change on the tracts of land BLM and DOW would acquire with the proposal, which is primarily directed towards livestock and wildlife management. Presently, there are no specific management plans for these tracts.

Superior presently owns both the surface and mineral rights on 590 acres on which the majority of the proposed processing plant would be located. When the proposed project is complete, Superior plans to retain ownership and return the use of the land to agriculture.

Project Construction

Pre-Construction Activities

During the 18 month pre-construction period the permits and other authorizations needed to construct and operate the proposed project would be obtained. Also, preparation of detailed engineering designs would begin and the construction work force mobilized.

Auxiliary Facilities

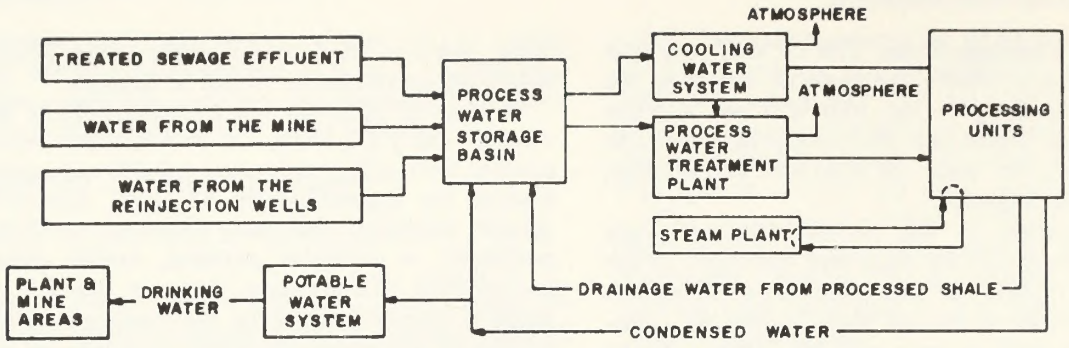
ELECTRICAL SYSTEM

Electrical power would be supplied by tapping an existing 138 kilovolt (kV) transmission line. This voltage would be transformed at the main substation to 13.8 kV and transmitted to the portal and plant sites. An unsurfaced road would be constructed for access to the main substation off an existing dirt road that intersects Piceance Creek Road. The substation would be enclosed with 8-foot high chain link fencing.

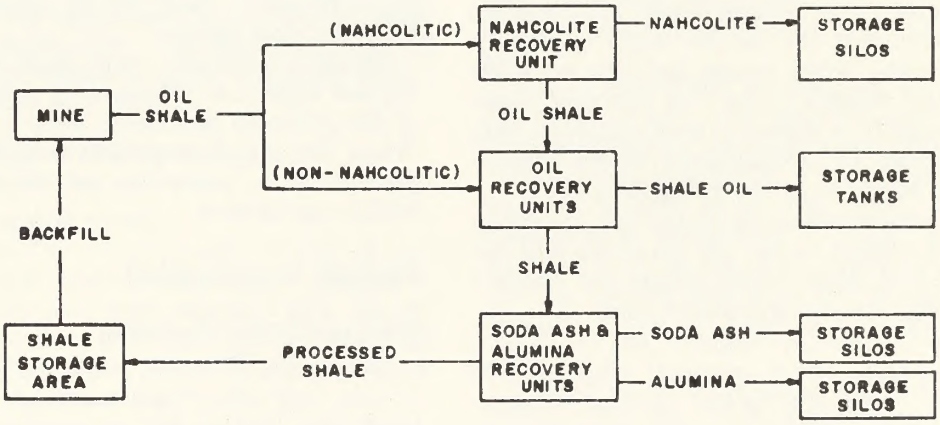
Powerlines would be constructed to connect the main substation to the distribution network within the plant and the main substation with the mine substation where the voltage would be transformed to meet construction and mining equipment needs. Single wooden poles, with conductors at a minimum span of 5.5 feet, would be used.

POTABLE WATER SYSTEM

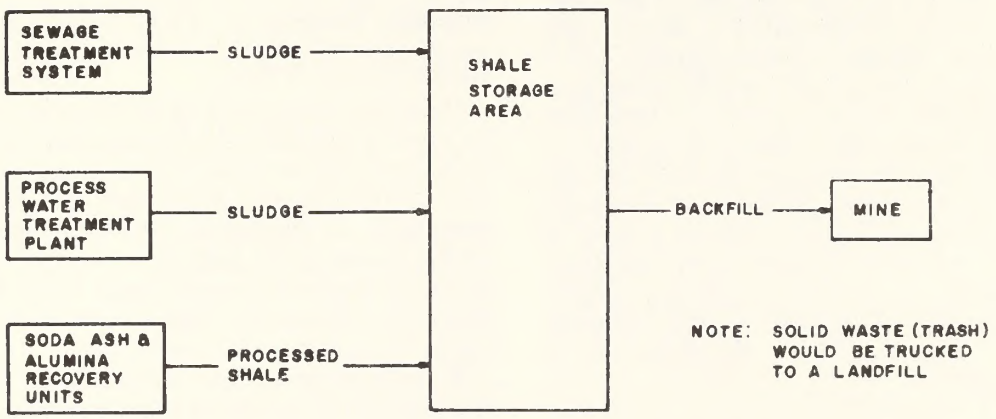
Water would be trucked from Meeker to the plant and mine areas for about 6 months until the potable water facilities are constructed. For approximately 4.5 years, until the plant is in full oper-



A. OPERATION OF THE PROCESS WATER SYSTEMS



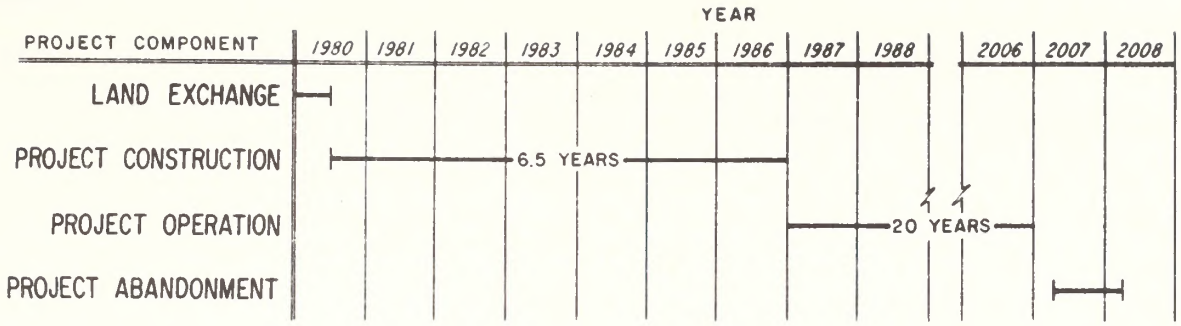
B. FLOW OF OIL SHALE



C. DISPOSAL OF PROCESS WASTES

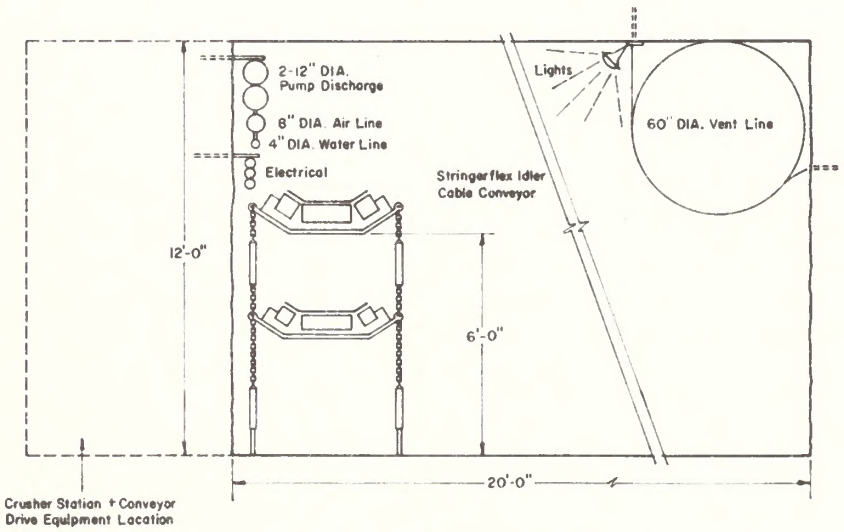
SIMPLIFIED DIAGRAMS OF THE PROPOSED PROCESS WATER SYSTEM OPERATION, FLOW OF OIL SHALE, AND DISPOSAL OF PROCESS WASTES

FIGURE 1-1



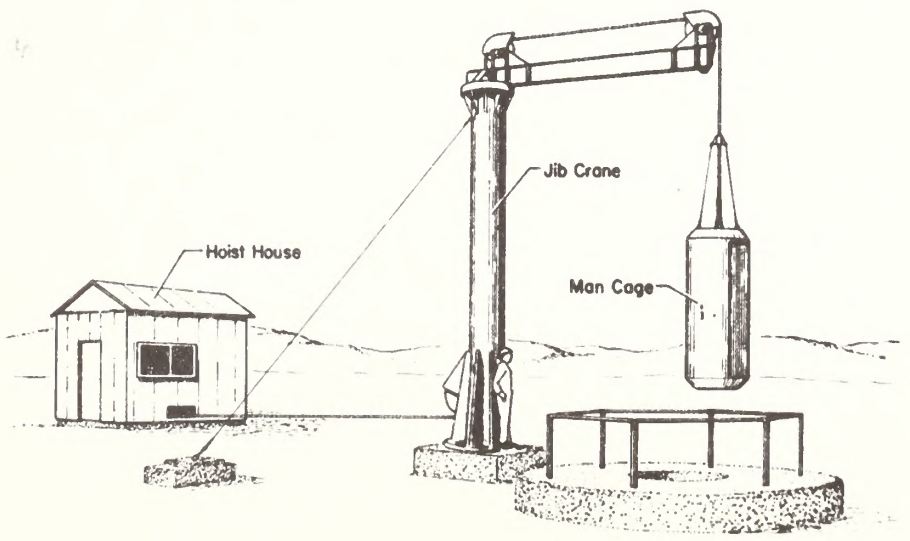
GENERALIZED ASSUMED SCHEDULE FOR THE PROPOSED SUPERIOR OIL PROJECT

FIGURE 1-3



CROSS SECTION VIEW OF THE PROPOSED NO.1 ADIT

FIGURE 1-4



AN ILLUSTRATION OF THE PROPOSED ESCAPE HOIST

FIGURE 1-5

ation, about 6,000 gallons of water per day would be pumped from the White River and treated. Two 30 gallons-per-minute capacity pumps, one serving as a backup, would be installed adjacent to the river. A 4-inch diameter water line would be constructed to connect the pumps to the domestic water treatment plant. Once full-scale production begins, condensed water from the soda ash and alumina processing units would supply all requirements for potable, or drinking, water. The 4-inch line would be maintained for emergency use until the project is abandoned.

The domestic water treatment plant, with a capacity of 50,000 gallons per day, would be constructed adjacent to Piceance Creek Road, east of the plant site. A 4-inch diameter pipe would connect the treatment plant to the 58,000 gallon domestic water storage tank. The tank would be enclosed with 8-foot high chain link fence. Access to the storage tank would require construction of an unpaved road. An 8-inch diameter pipe would connect the storage tank with the plant.

At the mine portal area, a 10,000 gallon domestic water storage tank would be constructed. A 3-inch diameter line would connect the portal water storage tank to the domestic water storage tank.

Installation of water lines, as with all piping associated with other project facilities, would be accomplished by continuous trenching, pipe laying, and backfilling. The backfill, which is the earthen material excavated and used for filling in around the lines, would be contoured to help prevent interference with natural drainage patterns.

SEWAGE TREATMENT SYSTEM

Sanitary needs of the construction crews would be met by portable chemical toilets for about two years until the sewage system is complete. The approximately 430 gallons per day of sanitary wastes would be hauled to the sewage treatment facility in Meeker for disposal.

Tertiary sanitary sewage treatment plants would be constructed at the plant site and mine portal areas. The modular facilities would have maximum daily treatment capacities of about 48,500 gallons at the plant and 11,500 gallons at the portal. Pipe would be laid to transport collected sanitary sewage to treatment plants. To transport the treated effluent, which is the outflow from the sewage plant, a 10-inch diameter pipe would be laid to the process water storage basin. Concrete tanks, associated with the portal treatment plant, would be constructed to hold the effluent which would be piped in the 18-inch diameter process water pipeline to the process water storage basin.

An industrial waste treatment plant, with a maximum capacity of about 340,000 gallons per day, would be constructed to treat all runoff from the plant site. The collection system would consist of lined storm ditches, piping, and pumping stations. A 200- by 200-foot catch basin would store the surge prior to treatment.

Mine

MINE DEVELOPMENT

To provide access to the mine portal and eliminate potential backwater buildup during a flood condition, a concrete surfaced road would be constructed off Piceance Creek Road. The creek would be channeled through a 230-foot long culvert consisting of three 12-foot diameter conduits which would have a total capacity of about 4,500 cubic feet per second. Construction access would be provided by an existing vehicular trail that crosses the creek. Approximately 1,200 feet of a meandering, or winding and turning, section of Piceance Creek would be cut off by the culvert. Excavation would occur between the meander. Once the culvert is in place and the concrete flared outlet poured, water would be directed through the culvert. Cofferdams, which are temporary watertight enclosures, would be used to allow construction of the concrete inlet.

In preparing the portal about 6 inches of soil would be stripped from the site. The approximately 16,130 cubic yards of soil would be stored in a stockpile on a 1-acre site and, as with all soil stockpiles, compacted, mulched, seeded with locally adapted species, and fertilized for stabilization. Work at the portal would generate an additional 351,000 cubic yards of earthen material. All of this material would be used to level the portal site, thereby providing an area on which to locate facilities, including the office, warehouse and shop, change house, and concrete-surfaced parking area. All buildings would be of prefabricated metal construction. To provide security, the 40-acre portal area would be fenced with an 8-foot high chain link fence.

A powder, or explosives, storage facility would be constructed northeast of the portal area. It would be a portable skid-mounted shed located and barricaded in accordance with federal and state requirements (*U.S. Department of Treasury, 1976*). The facility would be enclosed with an 8-foot high chain link fence. An existing roadway would provide access from the portal area.

Fuel storage tanks would be located at both the mine portal and plant areas. At both sites, an 8,000 gallon gasoline tank and a 14,000 gallon diesel tank would be buried. Construction and operation of all fuel storage facilities would be in accordance with state and federal requirements (*National Fire Protection Association, 1976, and U. S. Environmental Protection Agency, 1973*).

The No. 1 adit would be driven to gain initial access to the mine zones. Following the down dip of the formation, the adit would be about 11,600 feet long. A cross sectional view of the 12 foot by 20 foot adit is shown on Figure 1-4. As with all mine excavation, work would involve continuous drilling and blasting. This method of excavation would indicate subsurface geologic and hydrologic characteristics and would allow corrective or avoidance measures to be taken if problems occur. Approximately 180,000 cubic yards, or an average of 380 cubic yards of muck daily, would be crushed and conveyed to the surface and transferred to the muck conveyor for transport to the muck disposal area. Muck is the rock excavated in mining. A radial stacker would distribute the muck over the area. To control particulate emissions, baghouses with control efficiencies of 99.7 percent would be installed at transfer points of all project conveyors. A baghouse is an apparatus, or filter, for removing dust from air by using cylinders of closely woven fabric material which permits passage of air but retains solid particles.

An unsurfaced road would be constructed between the portal site and muck disposal area. About 6 inches of soil, or approximately 10,500 cubic yards, would be scraped from the 13-acre disposal area and stockpiled at the northern edge of the site. At the completion of the No. 2 and No. 3 adits, the stored soil would be spread over the muck disposal area to a depth of about 6 inches, mulched, planted with locally adapted vegetation, fertilized, and irrigated for two growing seasons. Water would be pumped from Superior's existing irrigation ditch.

A mine dewatering system would be constructed to remove and dispose of groundwater encountered during driving of the No. 1 adit and all mining that would follow. The system would include piping, a surge basin, and two reinjection wells which allow water to be forced, by pressure, into the geological formation. An 18-inch diameter pipe would be laid between the portal, where it would connect with a mine dewatering system, and the proposed reinjection wells.

A pumping station would be constructed at the surge basin. The station would have two 1,000 gallon-per-minute capacity pumps, one serving as a reserve, a diesel electric generator for backup power, and a manifold and piping system that would allow flow in both directions; either to the water storage basin or reinjection wells. Electrical powerlines to the station would be laid in the trench along with the 18-inch pipe.

The 1.5 million gallon capacity surge basin would be constructed by excavating and embanking the excavated material. The retainment structure would be keyed, or bonded, to the surface by wetting and compacting, and the basin would be lined with man-made impervious, or watertight, material. An access road would be constructed to the site off Piceance Creek Road.

Reinjection wells would be constructed to basically dispose of mine water during construction and before the plant would be in operation. And, during project operation, process water would be withdrawn. To accommodate the reinjection wells, a 200- by 200-foot pad would be leveled. The two wells would be drilled about 100 feet apart and 1,000 feet deep into the same lower aquifer from which the water would be obtained in the mine. Drilling water would be pumped from Superior's existing irrigation ditch and stored in portable tanks. The estimated 120 cubic yards of well cuttings would be hauled to the muck disposal area. The pipeline right-of-way would serve as access to the well site. An electrical powerline would be laid in the pipe trench from the portal to the wells. Two electrically-driven pumps with diesel-electric backup, would be installed to allow withdrawal from the wells.

An 18-inch diameter process water pipe would connect the pumping station at the surge basin to the process water storage basin at the plant site. When the plant is in operation, the water removed from the mine would be pumped to the plant for use in the process. If the sediment load in the mine water is too great for use in the process plant, it would be first allowed to settle in the surge basin. During project construction and when there would be excess water at the plant, the two-way valve would be reversed and the water disposed of in the reinjection wells.

PREMINING

Access from the end of the No. 1 adit would be developed within the mining zones. Drifts, or passageways, within the zones or levels would be excavated. To provide access between mine levels, ramps would be constructed. Ramps are inclined passages or roadways. Room would also be provided for installation of prefabricated shop and service area facilities, and for the slurry plant that would be used in backfilling the mine.

The No. 2 and No. 3 adits would be excavated parallel to and in exactly the same manner as the No. 1 adit. However, they would be larger, 30 feet by 30 feet, and excavated material from the adits and access development would be conveyed to the shale storage area at the plant for ultimate mineral recovery. The No. 2 adit would contain two 36-inch belt conveyors, one of which would have been removed from the No. 1 adit. Upon completion of adit excavation, an aerial tram for personnel transport would be installed in the No. 1 adit.

The average requirement of about 872,000 cubic feet per minute of fresh air in the mine would be drawn by the ventilation exhaust shaft constructed into the No. 3 adit. To provide access to the exhaust shaft, an unsurfaced road would be constructed off the road between the portal and muck disposal area. A 100-foot by 100-foot pad would be leveled for the drilling operation and a 4-inch diameter hole would be drilled from the surface followed by a 12-foot bore up from inside the adit. Drill cuttings would be conveyed to the plant site for mineral recovery.

The 12-foot diameter bore would be lined with concrete and two exhaust fans, one a reserve unit, and a backup diesel electric generator would be installed on a concrete pad. Electrical power would be supplied by a powerline from the mine substation. When in operation, fresh air would enter the No. 2 adit, be circulated through working areas by auxiliary fans, and drawn up the No. 3 adit and exhaust shaft.

A secondary access shaft would be drilled near the southern boundary of the project site for accessibility to the mine in case of emergency. The approximately 10-foot diameter shaft would extend from the surface about 2,500 feet into the lowermost mining zone. An area about 400 feet by 500 feet would be leveled to accommodate the drill rig. In addition, a storage area about 300 feet by 400 feet would be leveled. Access would be provided by the upgrading and maintenance of an existing roadway off Piceance Creek Road.

Two pits, lined with a man-made material which does not allow any flow through it, would be constructed to handle the drilling water and cuttings from the construction of the secondary access shaft. The pits would be contained in an area about 350 feet by 250 feet. Mine water pumped from the lower mine zone would be used for drilling. An approximately 4-inch diameter water supply bore would be drilled into the lower zone using a portable rig and water tanks. Water for this initial drilling would be pumped from the existing irrigation ditch adjacent to Piceance Creek Road.

The secondary access shaft and water supply bore would be cased and sealed with cement grout. An escape hoist, or elevator, would be installed in the access shaft (Figure 1-5). Electrical power would be supplied from within the mine. In addition, two diesel-electric generators would be installed for backup. All wastes, including drilling cuttings and the impervious pit linings, would be hauled to the muck disposal area. Upon completion of construction, the area would be contoured and planted with locally adapted species.

Plant

SHALE AND PROCESS WATER STORAGE AREA

The storage area would be constructed to store, regulate, and restrain materials used in the proposed process. Oil shale excavated during premining would be stored in the area. Work involved in mining during full operations would not produce a continuous steady flow of ore to the plant. To provide the required constant flow through the plant, oil shale would be stored in the shale storage area and added to the ore that would be directly conveyed to the plant from the mine. Materials that would be used to backfill the mine would be held, or staged, in the shale storage area. Water used in the process would be stored in the process water storage basin.

An existing 138 kV powerline would be relocated around the storage area. The relocated line would be strung on about 70 feet high H-frame wooden poles with a minimum wire span of 16 feet. Construction access would be gained by a vehicular trail along the right-of-way. This trail would be left in a passable condition for future powerline maintenance access.

A total of about 606,000 cubic yards of earthen material would be excavated during construction of the storage area. Of this amount, about 400,000 cubic yards of soil would be scraped and placed in a stockpile on a 20-acre site for use in revegetation during the abandonment component of the project. The stockpile would be mulched, seeded, fertilized, and irrigated for the first two years with water from the existing irrigation system. The remaining 206,000 cubic yards would be redistributed within the storage area.

Ditches would be constructed on the hillsides north and south of the storage area to intercept runoff and direct it to the inlet and outlet of the Piceance Creek conduit. The ditches would be constructed by excavation and construction of berms, which is the creation of an artificial ridge of earth. A cement mixture, or gunite, would be sprayed inside the ditch and on the berm to prevent erosion. In order to slow the flow velocity, concrete drop structures would be constructed along the length of the ditches to allow water to fall into a pool which would dissipate the velocity, or energy, of the flowing water and thereby reduce potential damage to the ditches.

Piceance Creek would be placed in three 12-foot diameter conduits laid in parallel. A horizontal cross sectional view of the conduits is shown in association with the dike on Figure 1-6. The 4,300-foot length of conduit, with a capacity of over 4,500 cubic feet per second, would be constructed in the stream channel by excavating temporary bypass channels between meander loops and the

use of cofferdams. These bypass channels would be gravel lined and drop structures installed to reduce flow velocities. Compacted backfill would be placed over the conduits to a depth of about six feet.

To protect the creek bed above and below the conduit, a concrete inlet and outlet would be constructed. The inlet would channel, or direct, water into the conduit. The velocity of the water would increase as it would flow through the conduit. In order to decrease the speed of flow, the outlet would have a wide gently sloping apron emptying into a stilling basin, or pool, before entering the natural creek channel.

The approximately 25 million gallon capacity process water storage basin would be excavated into bedrock by drilling and blasting. The basin would be about four acres in area and about eight feet deep. The entire basin would be lined with an impervious man-made material. Prior to plant operations, excess water would be naturally evaporated or disposed of through the reinjection wells.

A dike would be constructed over the Piceance Creek conduit to contain shale and water within the shale and process water storage area and prevent contaminants from reaching the creek. Approximately 43,000 cubic yards of compacted earthen material, generated from within the storage basin and at the plant site, would be placed around a concrete barrier extending into bedrock (Figure 1-6). Riprap, which is broken stone generated during construction of the process water basin, would be placed on the face of the dike to help prevent erosion.

The storage area would be contoured so that all drainage would flow into the process water storage basin. Once the area is shaped, compacted, and smoothed, a mobile radial stacker and associated movable conveyor system would be installed to handle crushed shale.

SUPPORT FACILITIES

As a result of preparing the plant site, a stockpile containing 245,000 cubic yards of soil and covering about 9 acres would be created. The approximately 280-acre plant site would be enclosed with an 8-foot high chain link fence. Parking areas and service roadways would be concrete paved within the enclosure. Prefabricated metal buildings would also be erected.

The fire control system, or fire loop, would consist of an existing 6,000 gallons-per-minute capacity pump on the White River, and an existing 12-inch diameter pipeline to the plant area, presently being used for irrigation, plus piping and hydrants. At the pump, a diesel-electric generator would be installed for backup power. For additional water a tie-in would be made into the potable water system.

Liquified petroleum gas (LPG) would be used for the initial 6-month start-up period of the oil recovery unit and provide fuel for other facilities until the plant is in full operation. At that time, process gas from the retort would supply those requirements. The LPG would be piped to the unit from two 40,000 gallon capacity storage tanks which would be set on concrete pads and surrounded by a retainment dike.

Natural gas would be used during the initial 3 1/4 years of nahcolite production when the plant would not be in full operation. A 4-inch diameter pipe would transport the gas from an existing collection line presently serving a producing well.

Two 36-inch wide overland conveyors would be constructed to transport the shale from the mine portal to the secondary crusher at the plant site (Figure 1-7). One conveyor would transport the nahcolite-rich shale while the other would transport dawsonite-rich shale. Materials to be backfilled in the mine would be carried on the reverse side of the conveyor belts. A maximum grade of 10 percent would be maintained along the route of the conveyor with a maximum height of about 25 feet reached where the conveyor would cross Piceance Creek Road. A maintenance road would be maintained along the approximate 30-foot right-of-way.

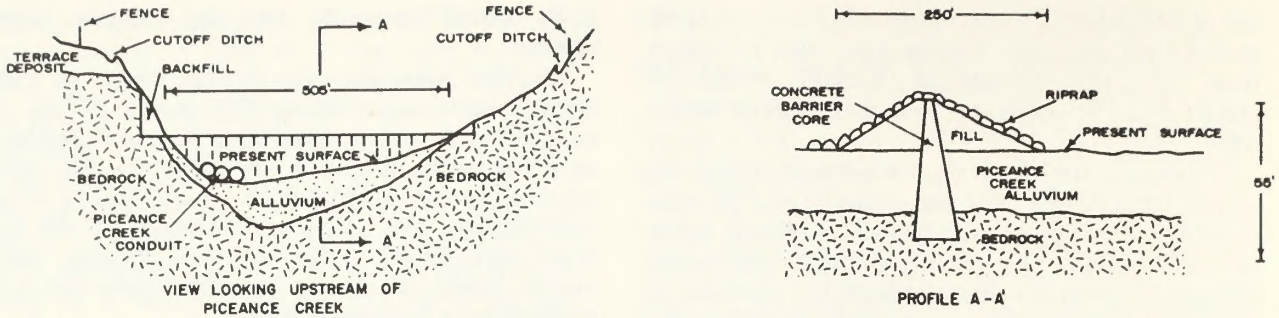
Several 24-inch wide conveyors would be constructed within the plant area. To transport shale from the secondary crusher a conveyor would extend to the shale storage area and be connected to a portable conveyor with a radial stacker at its end. Another conveyor would be built to transport the shale from the storage area to yard conveyors that would move materials to the processing units. From the processing units conveyors would be constructed to move the products other than oil to the storage and load-out facilities.

Within the plant site, pipe would be laid to carry process-related liquids. Excess soil excavated from this operation, about 1,200 cubic yards, and from other plant construction activities, would be used in the construction of the dike at the shale and process water storage area and in leveling and reshaping the site.

PROCESS WATER SYSTEM

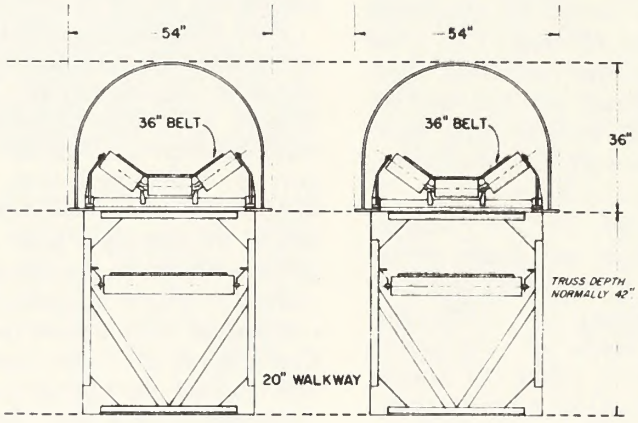
Cooling Water System

The cooling water system would be constructed to supply and circulate cooling water to the processing units. Two 3,000 gallons-per-minute capacity pumps would be installed at the process water storage basin and an 18-inch diameter pipe would connect the pumps and cooling tower. A 4-inch diameter line would be tapped into the 18-inch pipe and



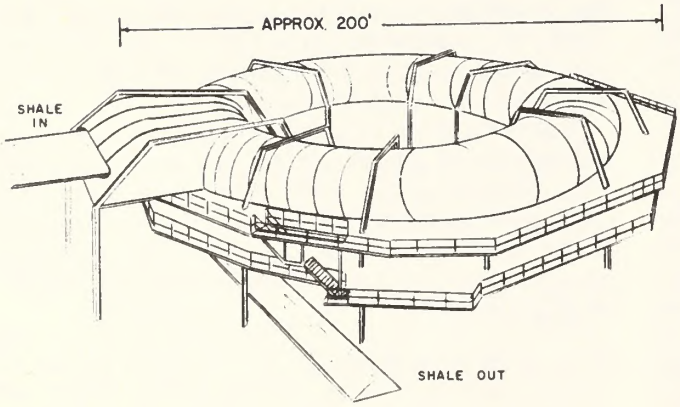
CROSS SECTION VIEWS OF THE PROPOSED DIKE

FIGURE 1-6

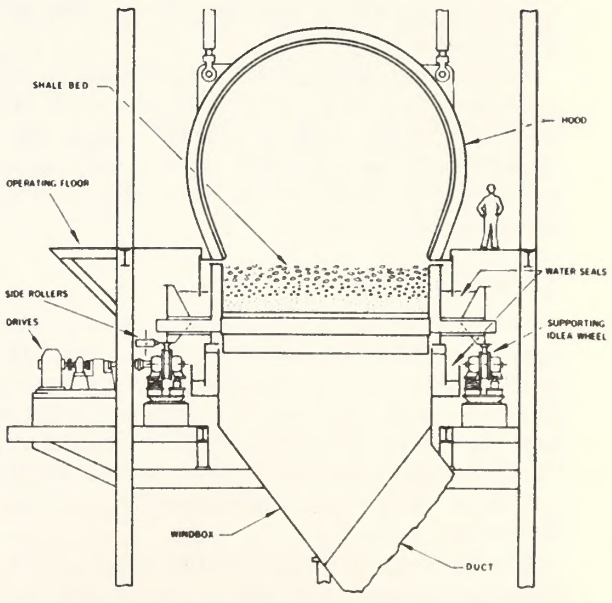


CROSS SECTION VIEW OF THE PROPOSED OVERLAND CONVEYORS

FIGURE 1-7



CONCEPTUAL VIEW OF THE PROPOSED CIRCULAR GRATE RETORT



CROSS SECTIONAL VIEW OF THE PROPOSED RETORT

CONCEPTUAL AND CROSS SECTION VIEWS OF THE PROPOSED RETORT

FIGURE 1-8

be run to the process water treatment plant to supply makeup water to that facility.

An induced draft counterflow cooling tower, 250 by 50 feet and 30 feet tall, would be erected. From the cooling tower a 36-inch diameter pipe would be laid to the processing units and back to the tower. Another length of 18-inch diameter pipe would be laid between the tower and process water treatment plant for piping of continuous blowdown from the tower. Blowdown is water released, or drained, to dispose of concentrated dissolved solids it would contain.

Steam Plant

Both the steam and process water treatment plants would be located in a prefabricated building. The steam plant would be constructed to drive power turbines in the processing units and provide heat throughout the plant, predominantly for the soda ash and alumina processing units and the oil storage tanks. A boiler would be installed and, to exhaust emissions, a 20-foot diameter concrete stack 200 feet high would be constructed. Pipe of varying diameters would be laid to circulate the steam and carry the water back to the steam plant.

Process Water Treatment Plant

The process water treatment plant would be constructed to condition the water that would be used for leaching soda ash and alumina in the process. Also, the treated water would be used to replace losses due to condensation and evaporation from these processing units. Installed within the plant would be a lime treatment facility. Between the treatment plant and processing units an 8-inch diameter pipe would be laid.

PROCESSING UNITS

Nahcolite Recovery Unit

Three facilities would be constructed; a secondary crusher, storage dome, and recovery unit. The secondary crusher would consist of a bank of crushers that would be located in a prefabricated building. In addition to the crushers other process equipment would include screens to sift the crushed shale and baghouses for emission control.

The storage dome would store the water soluble nahcolite so that the surge-like production from the mine through the crushers could be transferred to the recovery unit in an even-flow manner. A prefabricated building with a semicircular roof of corrugated metal that curves down to form walls would enclose the storage dome.

The nahcolite recovery unit would be housed in a prefabricated building. Process equipment that would be installed include crushers, screens, kilns for calcining, sorting equipment to separate the nahcolite, and baghouses.

Oil Recovery Unit

The recovery unit, or retort, would be donut-shaped with a diameter of about 200 feet (Figure 1-8). The unit would employ a movable grate on which to load the ore. The grate would move through separate zones at controlled temperatures and speed to maximize efficiency of shale oil production and conditioning of the dawsonite for later mineral extractions. Mechanical and water seals would prevent emission of pollutants, including odor. A 6-inch pipe would be laid to connect the oil recovery features of the unit with the oil storage tanks.

Soda Ash and Alumina Recovery Units

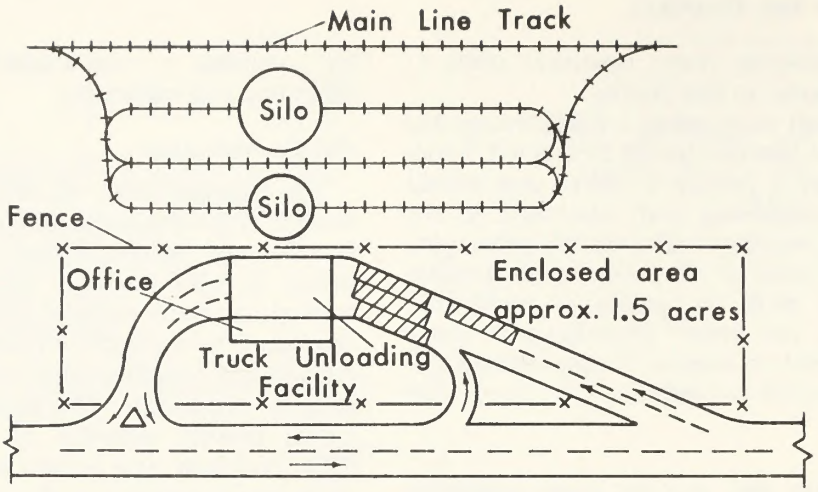
The recovery units would primarily utilize a leach system to remove the minerals. Process equipment, including filters, wash devices, crystallizers, and dryers, would be installed in a prefabricated building.

PRODUCT STORAGE AND LOAD-OUT FACILITIES

Concrete silos would be constructed for storage of the nahcolite, soda ash, and alumina. The two nahcolite silos would be about 65 feet in diameter and 115 feet tall. The soda ash and alumina silos would be 60 feet in diameter and 90 feet high, and 45 feet in diameter and 95 feet high, respectively. Identically sized soda ash and alumina silos would be constructed at a storage and load-out facility to be constructed in Rifle (Figure 1-9). The specific site for the proposed facility in Rifle has not been determined but would be located adjacent to the existing railroad south of town.

Two heated metal tanks, each about 120 feet in diameter and 48 feet high, would be erected to store the shale oil. For safety an impermeable earthen dike about 8 feet high would enclose the tanks. A 6-inch pipe would be laid from the tanks to the oil load-out facility. All load-out facilities would be equipped with sealed systems to prevent the escape of vapors and dust during loading and unloading.

A paved road would be constructed to facilitate truck load-out. In addition to the roadway around the product storage silos and tanks and load-out area, an overpass would be built over Piceance Creek Road to reduce traffic obstructions on that road.



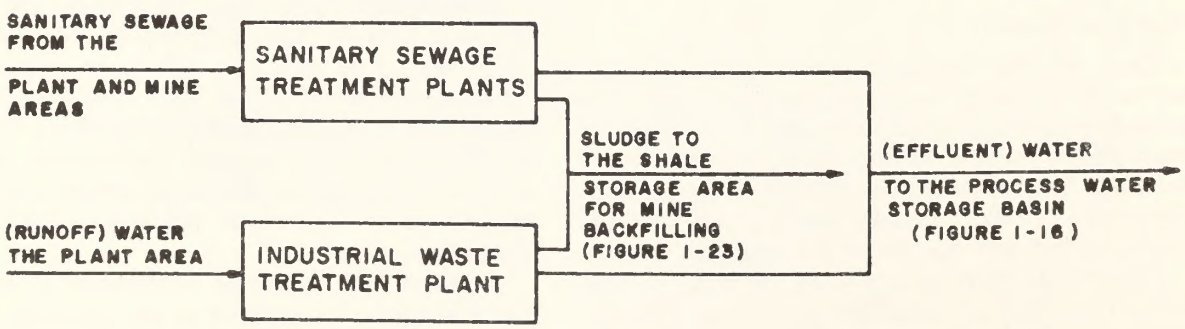
LAYOUT OF THE PROPOSED SODA ASH AND ALUMINA STORAGE AND LOADOUT FACILITIES AT RIFLE, COLO.

FIGURE 1-9

(CONDENSED) WATER FROM THE SODA ASH AND ALUMINA RECOVERY UNITS (FIGURE 1-22)
DOMESTIC WATER TREATMENT PLANT
(POTABLE) WATER TO THE MINE AND PLANT AREAS

SIMPLIFIED OPERATIONAL DIAGRAM, POTABLE WATER SYSTEM

FIGURE 1-10


SANITARY SEWAGE FROM THE PLANT AND MINE AREAS
SANITARY SEWAGE TREATMENT PLANTS
(RUNOFF) WATER THE PLANT AREA
INDUSTRIAL WASTE TREATMENT PLANT
SLUDGE TO THE SHALE STORAGE AREA FOR MINE BACKFILLING (FIGURE 1-23)
(EFFLUENT) WATER TO THE PROCESS WATER STORAGE BASIN (FIGURE 1-16)

SIMPLIFIED OPERATIONAL DIAGRAM, SEWAGE TREATMENT SYSTEM

FIGURE 1-11

Project Operation

Auxiliary Facilities

ELECTRICAL SYSTEM

The maximum requirement for electrical power would occur during operation of the project. During this time, an average of approximately 738,000 kilowatt hours of electricity would be used daily.

POTABLE WATER SYSTEM

Condensed water from the soda ash and alumina processing units would supply the average daily requirement of about 50,000 gallons (Figure 1-10). The water would be pumped to the domestic water treatment plant, treated, and piped to the domestic water storage tank. Water would then be gravity fed to the plant for use and to the mine area for storage and use.

SEWAGE TREATMENT SYSTEM

The sewage treatment system would produce a total of about 0.4 million gallons of treated effluent and 2.5 tons of sludge daily (Figure 1-11). The treated effluent includes precipitation and about 9,000 gallons daily, every day of the year, pumped from the White River through the fire loop to test that system. The water from testing the fire loop would be collected and routed to the industrial waste treatment plant by a storm sewer system. Until construction is complete on the process water storage basin, effluent would be hauled to the existing sewage treatment plant at Meeker, Colorado. From then on, effluents would be piped to the process water storage basin for reuse in the processing units. Sludge would be trucked to the shale storage area where it would be placed on the overland conveyor for backfilling of the mine.

Mine

Mining would occur on three levels within the mining zone (Figure 1-12); the lower level contains nahcolite-rich oil shale, the middle level is dawsonite-rich, and the upper level contains both minerals in mineable quantities. Production would vary between levels to accommodate market demand for the different products. The three levels would be developed in superimposed panels designed to follow the average natural inclination, or deviation from horizontal, of the mine zone which is about 14 degrees.

Panels would be about 100 acres in size with about 100-foot thick barrier pillars separating the panels (Figure 1-13). Along with the barrier walls, pillars would be left within the panel for structural strength. The distance between pillars would be between 45 and 60 feet. If unexpected conditions occurred, such as structural failure or excessive water, the panel would be sealed off and bypassed without disrupting work in other panels. Panel mining would also allow processed shale to be backfilled in the mine simultaneously with mine production.

Blasted shale would be conveyed to the primary crusher where it would be sized to less than 8 inches. The crushed shale would be transported by the overland conveyor to the secondary crusher where it would be crushed to less than 3 inches.

Initial production mining would be restricted to the lower level where testing and proving of mining techniques would occur along with the production and marketing of nahcolite. About 9,400 tons of nahcolite-rich oil shale would be produced daily for a total of about 4,422,000 tons over the 2-year period of nahcolite only production. Approximately 3,350 tons daily of nahcolite product would be separated and 6,050 tons of nahcolite-stripped shale, including fine materials from crushing, conveyed to the shale and process water storage area. In addition, about 1,950 tons per day would go directly to the shale storage area from the secondary crusher as a result of construction of the No. 2 and No. 3 adits and access ramps connecting the upper and middle zones to the lower zone during premining. This shale would be removed and stored in the shale storage area to provide working space in the mine and allow ultimate processing and recovery of minerals.

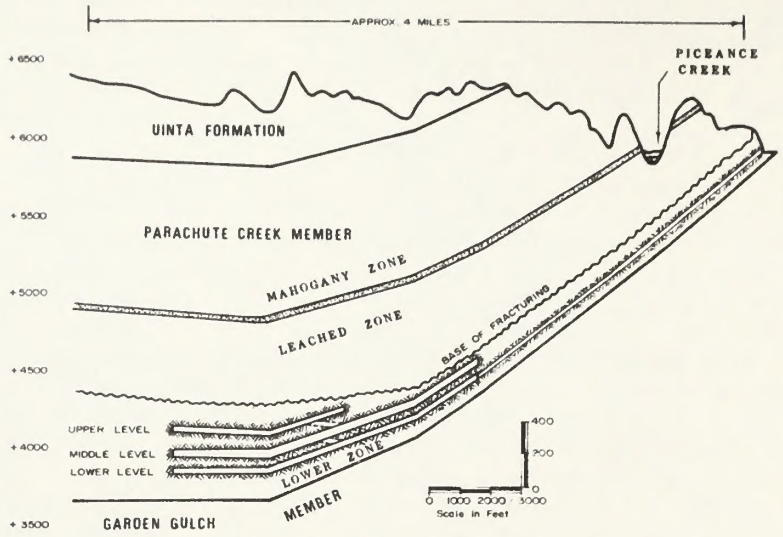
An average of approximately 26,175 tons daily would be mined during full scale production (Figure 1-14). The nahcolitic and non-nahcolitic oil shales would be kept separated through the underground primary crushers, overland conveyors, and secondary crushers at the nahcolite recovery unit.

Plant

SHALE AND PROCESS WATER STORAGE AREA

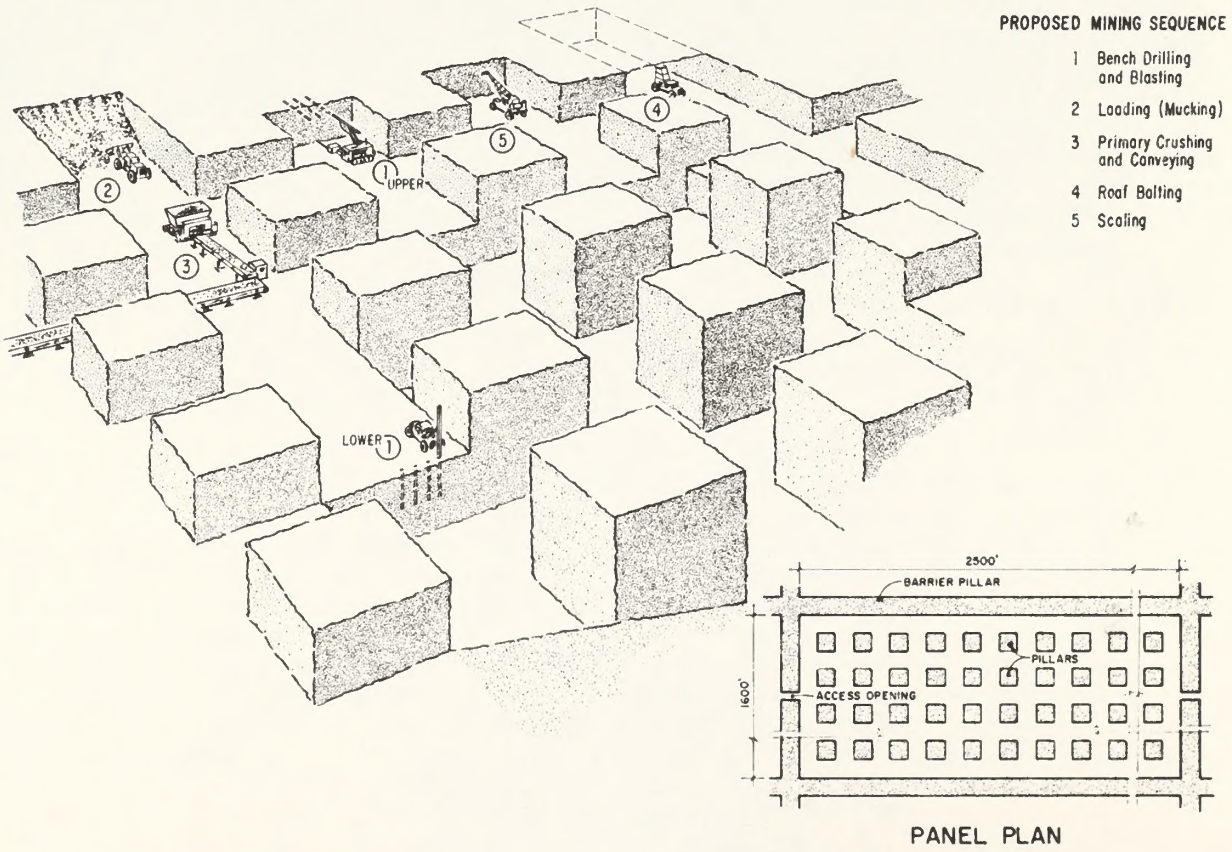
Shale Storage Area

An average, over about 3 years, of approximately 13,000 tons-per-day of shale would be conveyed to the shale storage area from the secondary crushers until full scale operation (Figure 1-15). An initial stockpile of about 14 million tons would be built up over about 3 years. This stockpile would be about 80 acres in size and about 80 feet high; roughly even with the plant site terrace. During the following 5 years a portion of the shale in the stockpile would be conveyed to the oil recovery unit for processing. After this time the stockpile would be reduced in size to about 5.5 million tons and maintained for about 18 years. The stockpile would then be depleted by the end of project operations.



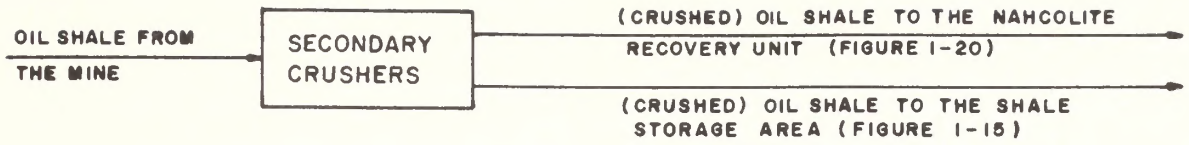
CROSS SECTION VIEW OF THE GEOLOGY
AND THE THREE PROPOSED MINING LEVELS

FIGURE 1-12



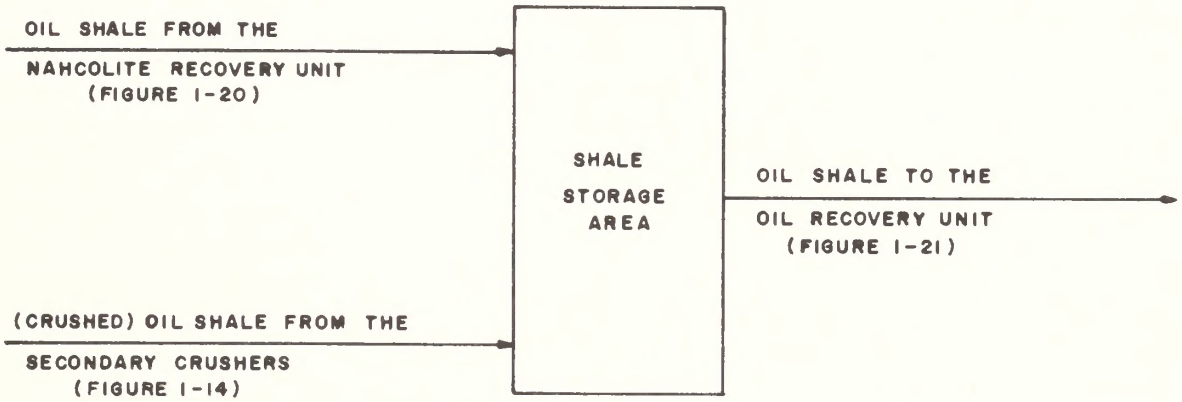
PICTORIAL VIEW OF THE PROPOSED MINING OPERATION

FIGURE 1-13



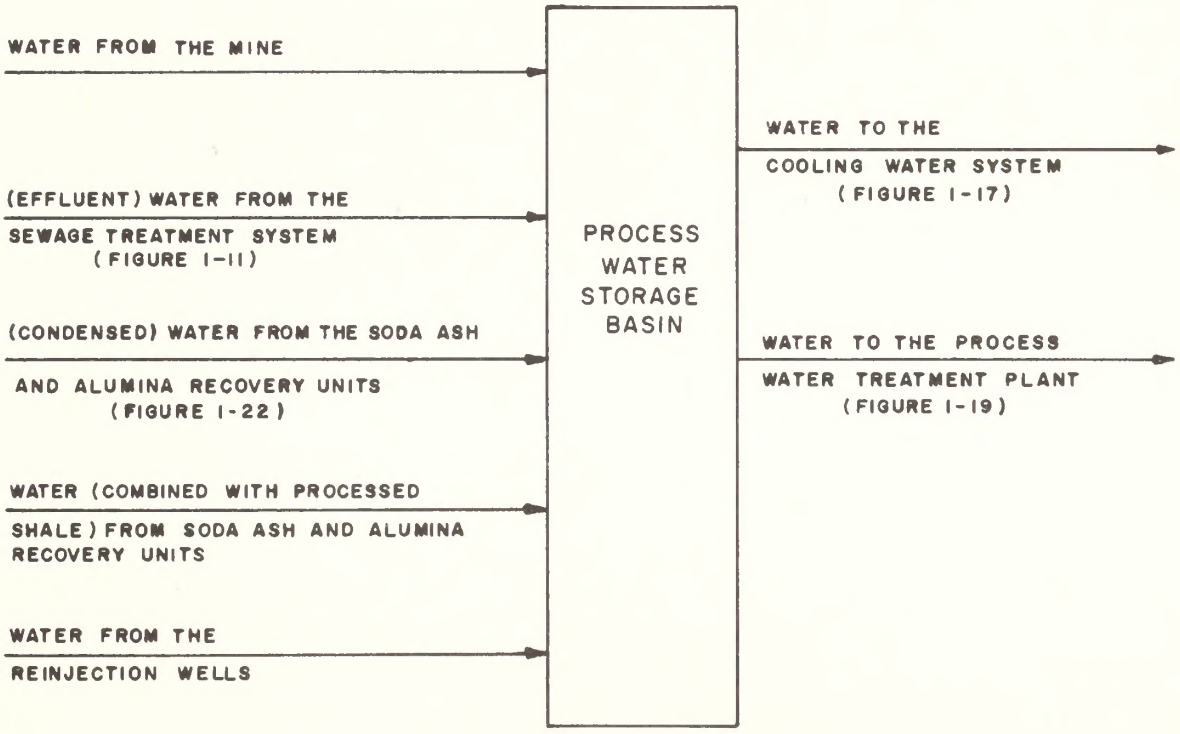
SIMPLIFIED OPERATIONAL DIAGRAM
FULL SCALE MINING & SECONDARY CRUSHING

FIGURE 1-14



SIMPLIFIED OPERATIONAL DIAGRAM, SHALE STORAGE AREA

FIGURE 1-15



SIMPLIFIED OPERATIONAL DIAGRAM, PROCESS WATER STORAGE BASIN

FIGURE 1-16

Process Water Storage Basin

About 4.4 million gallons daily would be pumped from the water storage basin to the process water system (Figure 1-16). This quantity equates to an average of about 3,055 gallons per minute pumped. From the mine, about 1.4 million gallons per day would be pumped into the basin, while another 1.0 million gallons would come from the dewatering of process shale in the shale storage area, and another 0.4 million gallons from the sewage treatment system. The remaining quantity of about 1.6 million gallons needed to balance inflow and outflow from the basin would be withdrawn from the reinjection wells.

PROCESS WATER SYSTEM

Cooling Water System

Except for the 118,000 gallons that would go to the water treatment plant, the approximately 4.4 million gallons of water daily that would be pumped from the process water storage basin would go to the cooling tower (Figure 1-17). This water would be combined with about 34.7 million gallons per day recycled from the processing units. After being cooled to 80 degrees F, about 25.6 million gallons per day would be pumped to the soda ash and alumina processing units and about 8.7 million gallons would go to the oil recovery unit. About 3.4 million gallons would be piped to the process water treatment plant as continuous blowdown. About 1.5 million gallons per day would be evaporated.

Steam Plant

Water for the steam plant would come from recycling within the essentially closed system that would require only nominal make up water. High pressure steam, about 5,900 tons per day, would be piped to the processing units to drive power turbines (Figure 1-18). Low pressure steam out of the units would be piped throughout the plant for process and oil storage heating. Approximately 1.4 million gallons of water per day would be returned to the steam plant.

Process Water Treatment Plant

Approximately 118,000 gallons per day of water pumped from the process water storage bain and 3.4 million gallons from the cooling water system would supply the treatment plant (Figure 1-19). 3.4 million gallons of the treated water would be piped to the soda ash and alumina processing units. Another approximately 118,000 gallons would be evaporated from the treatment facility. A ton of lime would be required daily for the plant. Sludge, about one ton per day, would be transported from the plant to the shale storage area for backfilling into the mine.

PROCESSING UNITS

Nahcolite Recovery Unit

During full scale operation over 12,300 tons per day of nahcolitic oil shale would be conveyed from the secondary crusher to the nahcolite unit (Figure 1-20). When necessary to balance output of the mine and the capacity, or thruput, of the processing unit, shale containing nahcolite would be temporarily deposited in or withdrawn from the storage dome. During processing about 5 percent of the nahcolite would be lost as fine dust collected in baghouses and 15 percent would remain in the oil shale and later recovered as soda ash. The average daily production of about 4,800 tons, consisting of 80 percent nahcolite and 20 percent residual oil shale by weight, would be conveyed to the nahcolite silos for shipment.

Purchasers of the nahcolite would load their trucks at the storage silos for shipment to the points of consumption. Since nahcolite is readily dissolved in water, the trucks would be sealed.

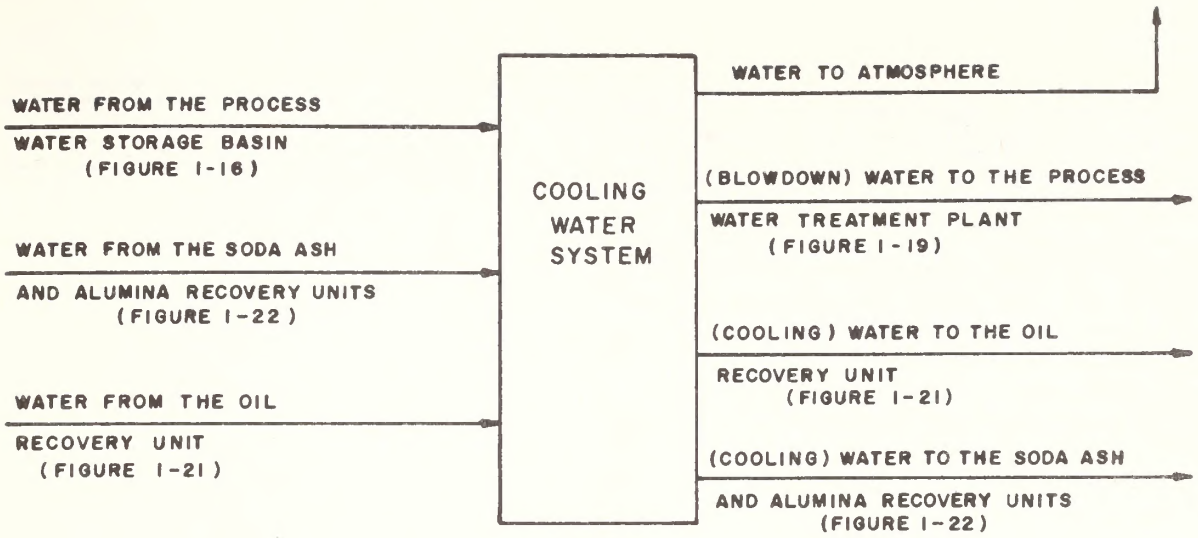
Oil Recovery Unit

From the secondary crushers, nahcolite recovery unit, and shale storage area, about 20,000 tons per day of oil shale would be fed on the grate of the retort (Figure 1-21). The shale would travel through three zones within the unit; the retorting, cooling, and air heating zones.

In the retort zone, indirect burners would heat a gas stream that would be passed through the shale bed. Kerogen, the substance in the oil shale that yields the shale oil, would be decomposed and carried as an oil mist by circulating gas to an oil removal system. The system would consist of a conditioner and electrostatic precipitor. In the conditioner the mist would be forced to form droplets consisting of a mixture of oil and water. The precipitor would then remove the droplets from the gas by electrostatic charging and subsequent precipitation onto a collector in a strong electric field.

The oil and water mixture would go to a separation tank. From the top of the tank about 11,500 barrels of oil daily would be removed and piped to the oil storage tanks. Superior would then truck the shale oil to Rangely, Colorado, for transport in existing pipelines. Approximately 180,000 gallons per day of water would be removed from the bottom of the tank, pumped to the shale storage area, and used to wet the processed shale as it would be placed on the overland conveyors for mine backfilling.

Process gas separated in the oil removal system would be used in the retort burners, inert gas gen-

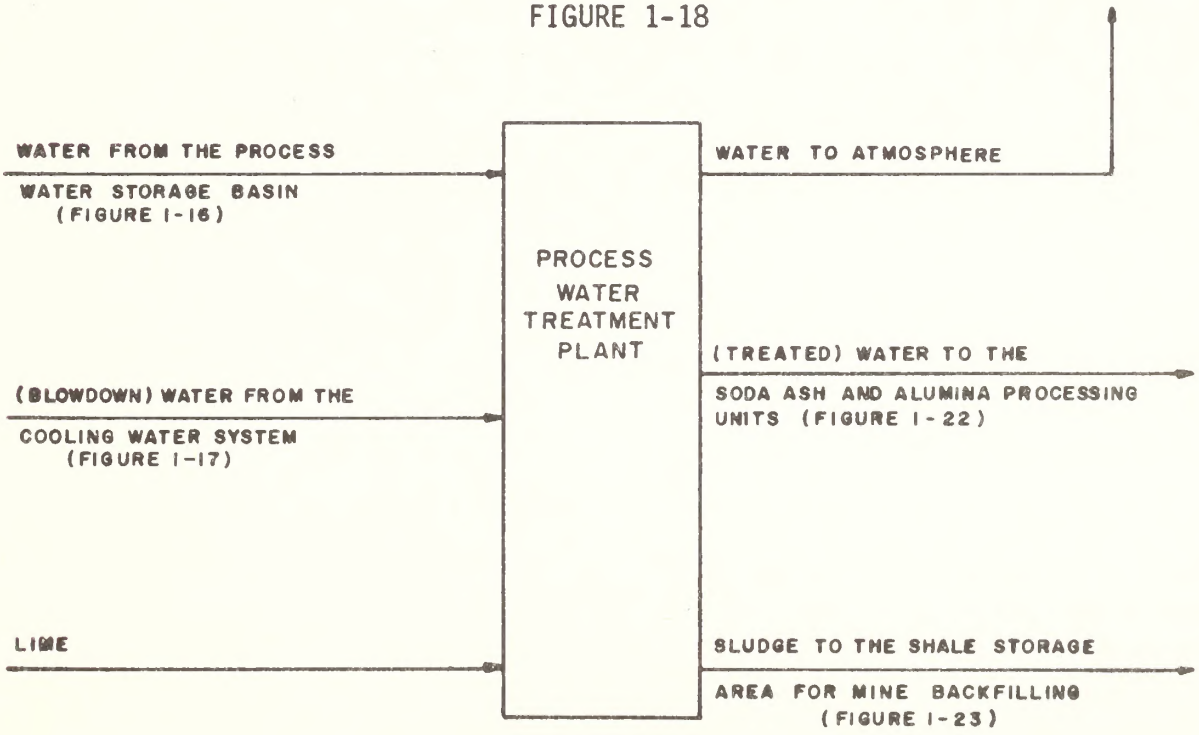


COOLING WATER SYSTEM

FIGURE 1-17

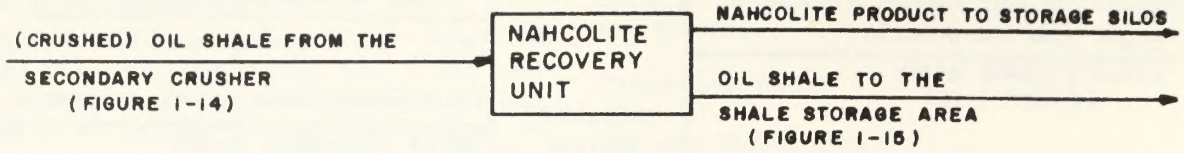
SIMPLIFIED OPERATIONAL DIAGRAM, STEAM PLANT

FIGURE 1-18



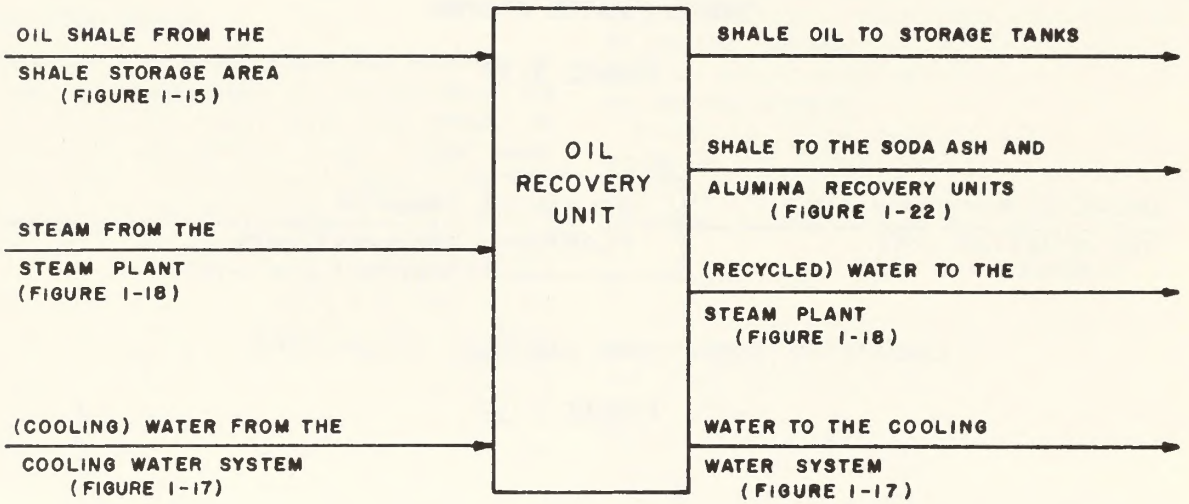
PROCESS WATER TREATMENT PLANT

FIGURE 1-19



SIMPLIFIED OPERATIONAL DIAGRAM, NAHCOLITE RECOVERY UNIT

FIGURE 1-20



SIMPLIFIED OPERATIONAL DIAGRAM, OIL RECOVERY UNIT

FIGURE 1-21

erator, and other plant facilities, including the steam plant. Gas from the inert gas generator, which would contain less than one percent oxygen, would be introduced into the retort where the oil shale would enter and, as a result, seal, or prevent, gas emissions. Within the unit, this heated gas would be used in the retort zone to dilute the burner, thereby controlling temperatures and used as the circulating gas, or carrier, for the oil mist.

In the air heating zone heat from the retorted oil shale is further recovered by passing air through the bed. The air is then used in the retort zone burners to increase combustion efficiency and in the nahcolite and soda ash and alumina recovery units.

Retorted shale would be discharged from the unit through a mechanical air seal and conveyed to the soda ash and alumina recovery units.

Soda Ash and Alumina Recovery Units

About 15,600 tons of retorted shale would be conveyed daily from the oil recovery unit to the soda ash and alumina units where it would first be crushed to increase leaching efficiency (Figure 1-22). The shale would be mixed with a leaching solution to dissolve the minerals. The approximately 3.4 million gallons daily of water from the process water treatment plant would serve to make up water lost from the leaching solution. The dissolved minerals and the solution would be physically separated from the shale and transported to crystallizers for removal of the minerals. Washed, or leached, for a second time to further remove minerals, the processed shale would be conveyed to the shale storage area for backfilling in the mine.

Following crystallization, the soda ash (Na_2CO_3) and aluminum hydroxide ($Al(OH)_3$) crystals would be washed and kiln dried, or calcined. Along with drying the products, calcining would also change the aluminum hydroxide to alumina (Al_2O_3). Approximately 580 tons per day of alumina and 1,000 tons of soda ash would be produced and conveyed to storage silos. Of the quantity of soda ash produced, about 43 percent would be derived from residual nahcolite in the oil shale and 57 percent from the dawsonite. Superior would truck the soda ash and alumina in sealed trailers to the proposed storage facilities at Rifle, Colorado, for ultimate rail shipment.

In the crystallization process about 270,000 gallons of water would be vaporized or distilled. The vapor would be condensed by water from the cooling water system. About 50,000 gallons of the distilled water would be piped to the domestic water treatment plant, chlorinated, and used for potable water requirements. The remaining 220,000 gallons would be piped to the process water storage basin.

BACKFILLING

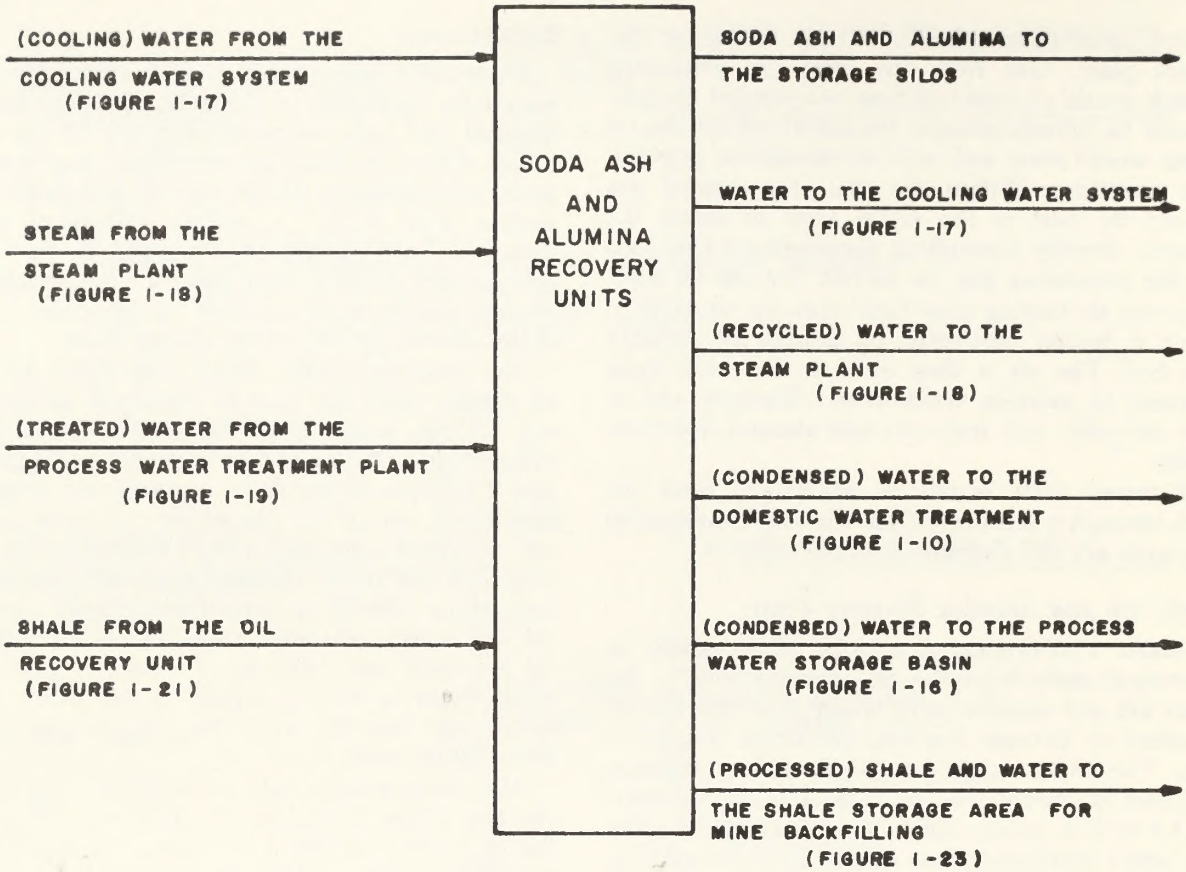
Processed shale, sludge, and collected dust would be backfilled in the mine to avoid surface disposal and help retard degradation of the mine pillars. From the soda ash and alumina processing units, approximately 13,950 tons of processed shale wetted with about 1.8 million gallons of water from the units would be conveyed to the shale storage area (Figure 1-23). Over a 3-day temporary storage period about one-half of the water would drain into the process water storage basin.

The processed shale, along with about 2.5 tons of sludge from the sewage treatment facilities, 1 ton of lime sludge from the process water treatment plant, 127 tons of dust collected in baghouses, and 1,100 tons of dust from crushing and screening operations, would be placed on the underside of the overland conveyor daily. Before being conveyed to the mine, the mixture would be wetted with about 180,000 gallons of water daily from the oil and water separation tank associated with the oil recovery unit. Another 3.6 million gallons of mine water would be added in the slurry plant within the mine to bring the moisture content to about 50 percent.

The slurry plant would be installed at the end of the No. 1 adit on the lower mine level. The backfilling system would also include pumps, about 80,000 feet of pipe, and other electrical distribution and control equipment. The slurry would be piped, at a rate of about 5,800 gallons per minute to the mine panels. At full operation two panels would be backfilled simultaneously from the roof of the panels. Drain pipes laid along the panel floor would collect the percolating water drained from the slurry. The water would be pumped back to the slurry plant for reuse. As a result of the natural down dip of the panels, each would be filled to the roof and then sealed with concrete.

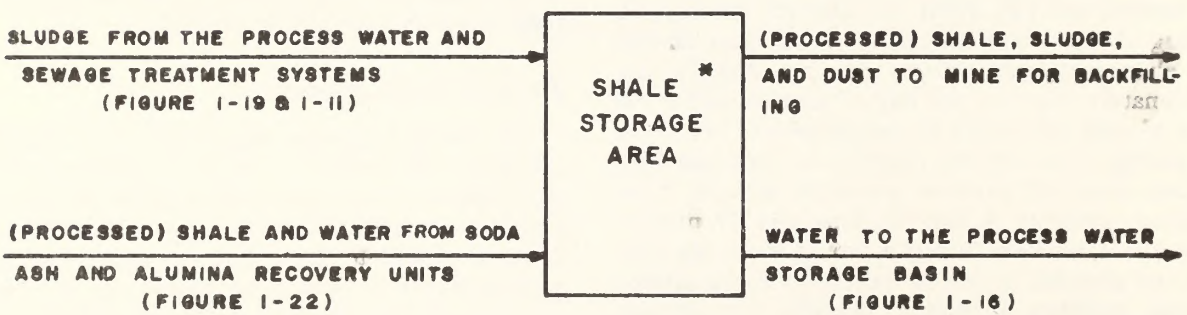
Project Abandonment

The metal from the project facilities would be salvaged and hauled to Rifle, Colorado, for rail shipment. All other materials, such as the concrete, would be hauled to the landfill near Meeker, Colorado. To facilitate the establishment of vegetation, compacted areas would be broken up, or ripped, and disked, or harrowed, before placement of soil from the soil stockpiles. Except for the approximately 185 acres that would be farmed, disturbed areas would be treated by planting with native species, seeds would be drilled and mulched, while forbs and shrubs would be planted, or set. The areas would be fertilized and irrigated for two growing seasons using the existing irrigation facilities and portable piping and sprinklers. During the two-year period, fences around the mine and plant



SIMPLIFIED OPERATIONAL DIAGRAM
SODA ASH AND ALUMINA RECOVERY UNITS

FIGURE 1-22



* FINE MATERIAL, OR DUST, FROM CRUSHERS AND BAGHOUSE WOULD ALSO BE DEPOSITED FOR MINE BACKFILLING.

SIMPLIFIED OPERATIONAL DIAGRAM, BACKFILLING

FIGURE 1-23

would be left in place to restrict livestock and wildlife use.

At the mine area steel plates would be placed over the adits, ventilation exhaust, and secondary access shaft. The concrete road off Piceance Creek Road, including the 230-foot culvert, would be left in place and maintained by Superior. Undisturbed buried piping would be left in place. All other facilities would be removed from the portal area. The site would be recontoured utilizing the earthen material used to level the portal site plus the 1-acre soil stockpile resulting in a soil cover of about 6 inches. The reinjection wells would be sealed with concrete, or grouted.

Along the dismantled overland conveyor alignment about 40,000 cubic yards of soil from the 20-acre stockpile would be spread and disked to encourage natural regrowth. The electrical distribution system would be removed; however, the relocated 138 kV line at the shale and process water storage area would remain in place.

The three 4,300-foot conduits in the shale and process water storage area would be cut in half and the lower portions fractured with explosives to allow ground water movement. The dike would be excavated and the concrete core removed. The approximately 43,000 cubic yards of earthen material removed from the dike would be combined with 360,000 cubic yards remaining in the 20-acre stockpile and spread over the storage area at a depth of about 2 feet prior to treatment and revegetation.

At the plant site, the main access road off Piceance Creek Road would be retained. The other project features would be removed and the approximately 245,000 cubic yards of soil from the 9-acre stockpile would be spread over the disturbed area to a depth of about 18 inches. The use of the area would return to irrigated farming.

Project Summary

Employment

Employment would begin about 1980 with approximately 20 people (Table 1-2). Peak employment would occur in 1985 with 1,329 employees. As construction is completed in 1986, the number of workers would remain a constant 920 through the project operation component, which ends in about 2006. The number of workers would trail off rapidly through the abandonment component, ceasing entirely in about 2008. Superior proposes to give hiring priority and provide training to local people and convert, when possible, construction workers to the mechanical skill category as construction activity winds down.

In 1980, a total of $394,136.00 would be paid as income to employees, increasing to a peak of $25,489,039.00 in 1985 (Table 1-3). After 1986 there would be a reduction in total wages and salaries paid of almost 10 million dollars. This would result from the termination of construction activity. Throughout the operation component, a constant level of $14,739,470.00 gross income of employees would be maintained.

Construction work would be on a one day shift for 6 days per week basis. During operation of the project work would be continuous, 24 hours per day and 7 days per week, and require about 230 employees to be working at all times.

Transportation

All materials and products would be trucked to and from the project site. Road segments in the project area that would be affected are shown in Figure 1-24. The number of trucks that would use the different segments is shown in Table 1-4. Individual truck loads were assumed to travel both to and from their destination and to stay within state axle-weight limitations. Haulage would take place 8 hours per day, 6 days per week, except during full operation. During this time, hauling would occur on a 24-hour-per-day basis for 365 days per year.

The soda-ash and alumina proposed for rail shipment out of Rifle would require about 16 rail cars, with 100 tons maximum load limits, per day. No unit trains are anticipated because it would take about 4 1/2 days to load a train of 75 cars.

Noise

Noise would be emitted throughout the life of the project. However, noise levels would be highest between about 1984, when initial nahcolite production would begin, and the end of project operation in about 2006.

Primary noise sources and their levels are: the overland conveyor at 75 decibels; secondary crushers at 90 decibels; burners and fans associated with the oil recovery unit at 75 decibels; and the cooling tower at 70 decibels.

Solid Waste Disposal

The quantities of solid waste proposed to be hauled to the sanitary land fill located near Meeker, Colorado, are shown in Table 1-5.

Air Emissions

Total suspended particulates emitted during the construction component of the project are shown in Table 1-6. Air emissions during operation of the project are shown in Table 1-7. The emission rates would occur throughout the entire operational component from about 1986 to 2007.

Sewage Disposal

An average of about 430 gallons per day would be trucked to the sewage treatment plant at

Skill Category	Average Number of Employees/Year 1980	1981	1982	1983	1984	1985	1986	1987-2006	2007	2008
Professional	12	30	62	65	68	70	72	105	45	5
Clerical	6	12	43	62	68	72	75	102	35	3
Technician	2	8	8	12	18	22	27	27	-	-
Operative	-	-	-	20	120	260	285	400	300	20
Mechanical	-	-	-	25	131	115	140	286	330	21
Construction	-	-	153	274	442	790	711	-	-	-
Total	20	50	268	458	847	1,329	1,310	920	710	50

Note:

Definitions: Professional - Administrative and scientific personnel

Clerical - Secretarial and other clerical positions

Technician - Skilled semi-professional people including draftsmen, and chemical laboratory technicians

Operative - Miners, plant operators, drivers, and guards

Mechanical - Building and maintenance tradesmen such as electricians, pipefitters, heavy equipment operators, and carpenters

Construction - Includes all the above skill categories

Employment remains constant throughout the operation of the project (1987-2006).

Employment figures for 2008 are for the first 3 months only.

EMPLOYMENT FOR THE PROPOSED SUPERIOR OIL PROJECT

TABLE 1-2

Skill Catagories	Average Annual Income	Total Incomes/Year 1980	1981	1982	1983	1984	1985	1986	1987-2006	2007	2008
Professional	25,000	300,000	750,000	1,550,000	1,625,000	1,700,000	1,750,000	1,800,000	2,625,000	1,125,000	125,000
Clerical	10,628	63,768	127,536	457,004	658,936	722,704	765,216	797,100	1,084,056	371,980	31,884
Technician	15,184	30,368	121,472	121,472	182,208	273,312	334,048	409,968	409,968	-	-
Operative	14,996	-	-	-	299,920	1,799,520	3,898,960	4,273,860	5,998,400	4,498,800	299,920
Mechanical	16,161	-	-	-	404,025	2,117,091	1,858515	2,262,540	4,622,046	5,333,130	399,381
Construction	21,370	-	-	3,269,610	5,855,380	9,445,540	16,882,300	15,194,070	-	-	-
Total		394,136	999,008	5,398,086	9,025,469	16,058,167	25,489,039	24,737,538	14,739,470	11,328,910	856,185

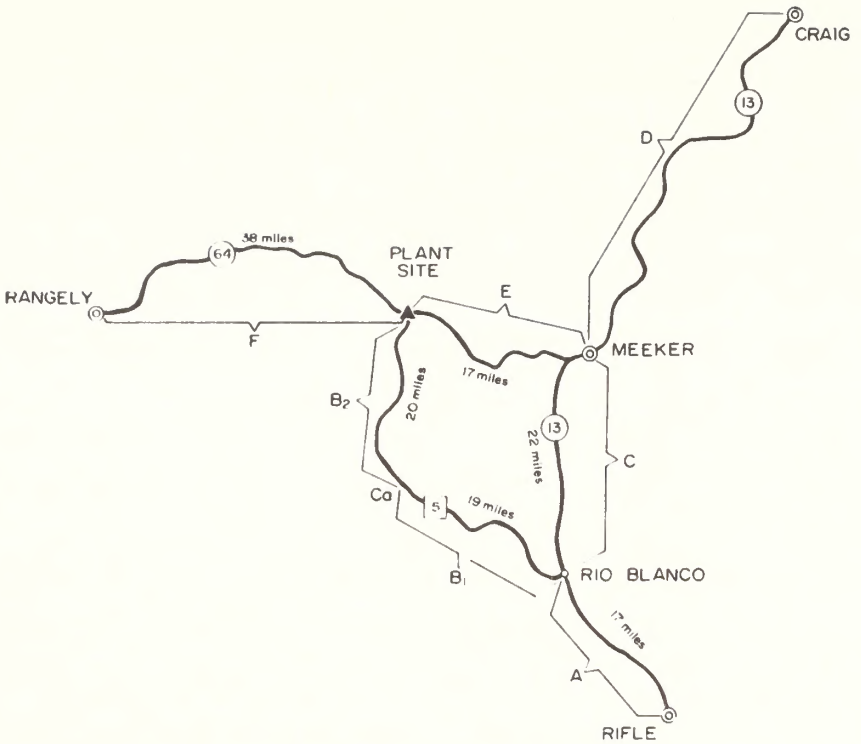
Note:

Incomes are in 1977 dollars.

Total incomes/year are derived by multiplying average annual incomes times number of workers from Table 1-2.

PROPOSED ANNUAL INCOMES BY SKILL CATEGORIES

TABLE 1-3



PROPOSED AFFECTED ROAD SEGMENTS

FIGURE 1-24

Year	Trucks/Road Segment A	B	C	D	E	F
1982	17	9	8	1	9	12
1983	37	19	18	28	46	19
1984	119	60	59	109	169	62
1985	140	70	70	121	191	75
1986	160	80	80	157	237	80
1987-2006	286	126	159	156	316	229
2007	4	2	2	1	31	1
2008	5	3	2	1	8	1

Note:

Refer to Figure 1-24 for location of road segments.

Quantities remain constant for each year during operation of the project (1987-2006).

Figures for 2008 are for the first quarter of the year only.

PROPOSED AVERAGE DAILY TRUCKS PER YEAR BY ROAD SEGMENT
(two way trips)

TABLE 1-4

	Year								
	1982	1983	1984	1985	1986	1987-2006	2007	2008	Total
Tons	191	299	1,433	495	80	520	104,724	7,532	125,154

Note:

Quantities remain constant throughout operation of the project (1987-2006).

PROPOSED TONS OF SOLID WASTE TO BE DISPOSED (tons/year)

TABLE 1-5

Source	Emission Rate lbs/hr (max lb/hr) 1982	1983	1984	1985	1986
Diesel Exhaust:					
TSP	1.8 (2.2)	2.0 (3.5)	4.2 (4.2)	2.4 (3.7)	0.5 (0.8)
SO_2	2.0 (2.9)	2.2 (3.7)	4.4 (4.4)	2.3 (3.0)	0.8 (0.9)
CO	35.6 (51.1)	69.2 (82.0)	45.5 (46.7)	51.2 (58.2)	30.4 (30.4)
NMHC	1.6 (3.7)	3.4 (4.0)	3.7 (3.7)	2.1 (2.6)	0.5 (0.5)
NO_x	28.9 (40.5)	29.8 (47.7)	62.6 (62.6)	32.9 (42.3)	8.9 (13.2)
Fugitive Dust:					
Construction Activities - TSP	42.6 (52.8)	29.1 (51.5)	3.6 (4.6)	7.2 (8.1)	1.4 (4.8)
Shale Storage Area Stockpile - TSP:					
Material Handling			2.4	2.4	2.4
Wind Erosion			1.2	1.2	1.2
Initial Operational:					
Nahcolite and Secondary Crusher - TSP			2.8	2.8	4.1
TOTAL TSP	44.4 (55.0)	31.1 (55.0)	14.2 (15.2)	16.0 (18.2)	9.6 (13.3)

AIR EMISSIONS DURING PROJECT CONSTRUCTION

TABLE 1-6

Source	SO_2	NO_x	NMHC	CO	TSP
Steam plant	308.20	42.00	1.00	17.00	5.00
Nahcolite kiln	4.16	12.00	0.04	0.23	3.15
Alumina kiln	15.22	8.54	0.15	0.83	15.00
Lime kiln	10.43	2.33	0.10	0.60	5.00
Inert gas generator	0.37	0.008	0.003	0.017	0.005
Oil storage tanks	-	-	15.00	-	-
Diesel exhaust (shale storage area)	1.50	17.80	1.40	4.30	1.30
Gasoline exhaust	0.015	0.273	0.371	11.30	0.017
Product transportation	0.70	1.33	0.71	6.73	0.32
Employee transportation	0.05	0.47	0.45	4.20	0.11
Mine Vent					
Diesel exhaust	6.30	87.20	1.34	1.90	6.00
Primary crusher	-	-	-	-	2.20
Secondary crusher	-	-	-	-	6.60
Storage dome	-	-	-	-	2.10
Tertiary crusher	-	-	-	-	1.47
Nahcolite screening	-	-	-	-	2.33
Photosorters	-	-	-	-	2.33
Oil recovery surge bin	-	-	-	-	4.30
Alumina/soda ash crusher	-	-	-	-	5.90
Conveyor belt, Misc. Handling, and Product Load Out	-	-	-	-	0.80
Fugitive Dust	-	-	-	-	11.17
Total	346.95	171.95	20.56	47.11	75.10

Note: SO_2 = Sulfur dioxide NO_x = Oxides of nitrogen

NMHC = Non-methane hydrocarbons CO = carbon monoxide

TSP = total suspended particulates

AIR EMISSIONS DURING PROJECT OPERATION (avg. lbs/hr.)

TABLE 1-7

Meeker. Haulage would occur between the start-up of the project construction, in about January 1982, and continue until mid-1983. Afterwards, disposal would be on site.

Land Requirements

Approximately 380 acres of land would be required for the proposal. A breakdown of acres needed for the different features of the project are shown in Table 1-8.

Water Requirements

The water requirements of the project are shown in Table 1-9.

Project Feature	Acres Required
Mine:	
Portal area	20
Soil stockpile, muck disposal area, and settling basin	20
Secondary access shaft	9
Reinjection wells	1
Roads, pipelines, and conveyors	21
Plant:	
Shale and process water storage basin	110
Plant site	170
Soil stockpiles	29
Total	380

LAND REQUIREMENTS FOR THE PROPOSED SUPERIOR OIL PROJECT

TABLE 1-8

Water Source	Quantity	Project Component	Time Frame	Use
White River	6,000 gallons/day	Construction	6 months	Potable water (hauled from Meeker)
White River	23,000 gallons/day	Construction	4.5 years	Potable water (treated on site)
White River	9,000 gallons/day	Operation	22.5 years	Fire loop testing
Piceance Creek	3.7 acre-feet/year	Construction	5 years	Irrigation (soil stockpiles)
Piceance Creek	52.6 acre-feet/year	Abandonment	1.25 years	Irrigation
Lower aquifer	3.3 million gallons/day	Operation	20 years	Process water

Note:

Specific time frames are shown in Figure 1-2.

WATER REQUIREMENTS FOR THE PROPOSED SUPERIOR OIL PROJECT

TABLE 1-9

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

Neither the environmental influences of the proposed Superior project nor of the interrelated projects, as described in Chapter 6, are considered in this chapter. Only the environment as it would exist without those projects and anticipated changes from ongoing trends are included. The information is presented within the time frame of the Superior proposal and is restricted to that information required to assess significant impacts in Chapters 3, 6, and 8. Additional background, technical, and other information is contained in the cited reference documents.

SOCIOECONOMICS

Employment, Income, and Population

Employment and Income

As indicated in Table 2-1, the largest number of employees in Garfield and Rio Blanco Counties work in the agricultural and mining industries. In Garfield County, agriculture is the principal employing industry but the trend is declining. Between 1970 and 1976, the number of employees working in agriculture declined from about 770 to 710 (*Colorado West Area Council of Governments [CWACOG], 1977*). During this same period, employment in mining increased from about 310 to 500 employees.

Mining employment surpasses agriculture in Rio Blanco County. As in Garfield County, the number of agricultural employees is declining, while in mining the number is increasing. In 1970, approximately 450 people worked in agriculture and 300 in mining. In 1976, there were about 350 in agriculture and 400 in the mining industry.

Less than one percent of the total income earned in Garfield and Rio Blanco Counties is from farming (Table 2-2). Corresponding to the employment figures, mining contributes the highest percentage of the incomes in the two counties.

Population

Trended, or projected, populations in Garfield and Rio Blanco Counties are shown in Table 2-3. A special census completed in 1977 is the basis for these projections (*U.S. Bureau of Census, 1978*). These base numbers were factored in accordance with methods described in CWACOG (1977).

Housing

Housing requirements of the trended population (Table 2-3) are shown in Table 2-4. These requirements were calculated based on the current number of people per dwelling unit as taken from the U.S. Bureau of the Census (1977). The number of people per unit is shown in Table 2-4. Based on the current mixture of single, multiple unit, and mobile homes, the types of housing needed to satisfy the housing requirements are shown in Table 2-5.

Community Services

As the population grows in the project area, community services would be required to maintain the existing quality of life in the area. Community services, or infrastructure, are those basic facilities, equipment, services, and installations needed for the functioning and growth of the communities. The trends presented in this chapter, and carried forward to other chapters, assume that new facilities would be built as existing facilities reach capacity, and that the existing service level would be maintained.

Water Treatment Facilities

Daily water treatment capacities for Rifle, Rangely, and Meeker are about 4.7, 2.1, 1.2 million gallons, respectively. Maintaining the current useage levels, these capabilities would serve approximately 10,000 people in Rifle, 5,000 in Rangely, and 4,000 in Meeker. Based on the trended population shown in Table 2-3, the capabilities of the treatment facilities would not be exceeded within the time frame of the proposed Superior project (Table 2-6).

Sewage Treatment Facilities

Rifle will, with upcoming added capacity, be able to treat about 1 million gallons per day. Rangely and Meeker can each treat about 400,000 gallons per day. Based on the generation of about 100 gallons of sewage a day per person, the sewage treatment systems have the capacity to serve the trended populations (Table 2-7).

Major Industry	Number of Employees/County Garfield	Rio Blanco	Average Incomes/County Garfield	Rio Blanco
Agriculture	101	Confidential	$12,699	Confidential
Mining	Confidential	512	Confidential	$14,647
Construction	619	114	12,738	15,249
Manufacturing	167	21	8,739	11,431
Transportation	549	149	13,776	14,428
Wholesale trade	144	23	10.504	9,402
Retail trade	1,703	259	6,278	4,794
Financing, insurance and real estate	256	47	9,954	9,942
Services	1,110	87	6,669	6,058
Public administration	28	Confidential	16,295	Confidential

Note:

Some figures are "confidential" because they could allow an unfair competitive edge in the industry or disclose information considered personal.

Source: Colorado Division of Employment, VI Research and Analysis, "Colorado Covered Employment 1977."

EXISTING EMPLOYEES AND AVERAGE ANNUAL INCOMES BY MAJOR INDUSTRIES FOR GARFIELD AND RIO BLANCO COUNTIES

TABLE 2-1

Industries and Sub-industries	% Total Income Garfield County	Rio Blanco County
FARM	0.02	0.24
NON-FARM	99.98	99.76
Private	83.31	70.52
(agriculture service, forestry, fisheries, and others)	(0.62)	(unavailable)
(mining)	(18.33)	(31.61)
(construction)	(13.64)	(7.86)
(manufacturing)	(2.81)	(2.01)
(transportation and public utilities)	(10.47)	(9.10)
(wholesale trade)	(2.47)	(1.61)
(retail trade)	(17.72)	(9.08)
(finance, insurance, and real estate)	(3.71)	(3.17)
(services)	(15.54)	(5.97)
Government and government enterprises	14.68	29.24
(federal, civilian)	(3.68)	(4.39)
(federal, military)	(0.21)	(0.20)
(state and local)	(10.79)	(24.65)

Note:

Source: U.S. Bureau of Economic Analysis, "Regional Economics Information System," 1978.

Not all figures add up to 100 percent because of rounding.

PERCENTAGES OF TOTAL INCOME ATTRIBUTABLE TO THE DIFFERENT INDUSTRIES IN GARFIELD AND RIO BLANCO COUNTIES (1976)

TABLE 2-2

Year	Population				
	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Meeker Only	Rangely Only
1980	22,122	2,633	5,379	1,947	1,974
1981	23,070	2,745	5,549	1,976	2,004
1982	24,018	2,858	5,539	2,005	2,033
1983	24,966	2,971	5,619	2,034	2,062
1984	25,914	3,084	5,698	2,064	2,091
1985	26,862	3,197	5,778	2,092	2,121
1990	31,603	3,761	6,177	2,236	2,267
1995	36,343	4,325	6,575	2,380	2,413
2000	41,083	4,889	6,974	2,524	2,559
2010	50,563	6,017	7,771	2,813	2,852

Note:

The figures reflect the assumed continuation of the growth experience between 1970 and 1977 and complete islotation from development of the proposed Superior Oil and interrelated projects.

TRENDED POPULATIONS OF GARFIELD AND RIO BLANCO COUNTIES

TABLE 2-3

Year	Rifle		Rangely		Meeker	
	Pop. Increase	Number of DU	Pop. Increase	Number of DU	Pop. Increase	Number of DU
1980	113	41	29	9	28	10
1981	112	40	30	10	29	11
1982	113	41	29	9	26	9
1983	113	41	29	9	28	10
1984	113	41	30	10	30	11
1985	113	41	29	9	30	11
1990	564	203	145	45	144	54
1995	564	204	143	44	154	58
2000	564	203	149	47	138	53
2010	1128	407	293	93	280	107
Total		1,262		285		334

Note:

The number of existing dwellings units are approximately 810 in Rifle, 590 in Rangely, and 685 in Meeker. The current number of people per dwelling unit is approximately 2.8 in Rifle, 3.17 in Rangely, and 2.7 in Meeker.

Number of Dwelling Units (DU) Required by Community

HOUSING REQUIREMENT FOR THE TRENDED POPULATION IN RIFLE, RANGELY, AND MEEKER

TABLE 2-4

Year	Rifle SUD	Rifle MUD	Rifle MH	Rangely SUD	Rangely MUD	Rangely MH	Meeker SUD	Meeker MUD	Meeker MH
1980	27	4	10	7	1	1	7	1	2
1981	26	4	10	7	1	2	8	1	2
1982	27	4	10	7	1	1	7	1	1
1983	27	4	10	7	1	1	7	1	2
1984	27	4	10	7	1	2	8	1	2
1985	27	4	10	7	1	1	8	1	2
1990	132	20	51	33	5	7	40	5	9
1995	133	20	51	33	4	7	43	6	9
2000	132	20	51	35	5	7	39	5	9
2010	264	41	102	69	9	15	79	11	17
Total	822	125	315	212	29	44	246	33	55

Note: The current mix of dwelling units in Rifle is about 65% single unit, 10% multiple unit, and 25% mobil home. In Rangely and Meeker, the mix is about 74% single unit, 10% multiple unit, and 16% mobil home.

TYPE OF DWELLING UNITS REQUIRED FOR THE TRENDED POPULATION IN RIFLE, RANGELY, AND MEEKER

Number of Single Unit (SUD), Multiple Unit (MUD), and Mobile Home (MH) Dwellings by Community

TABLE 2-5

Year	% Capability/Town Rifle MGD Needed	Rifle % Capacity	Rangely MGD Needed	Rangely % Capacity	Meeker MGD Needed	Meeker % Capacity
1980	1.24	26	.83	40	.58	48
1981	1.29	27	.84	40	.59	49
1982	1.34	29	.85	40	.61	51
1983	1.40	30	.87	41	.61	51
1984	1.45	31	.88	42	.62	52
1985	1.50	32	.89	42	.63	53
1990	1.77	38	.95	45	.67	56
1995	2.03	43	1.01	48	.71	59
2000	2.30	49	1.07	51	.76	63
2010	2.83	60	1.20	57	.84	70

Notes:

Assumes 470 gallons/person/day useage in Rifle (Source: Tom Cobb, Director of Public Services for Rifle).

420 gallons/person/day useage in Rangely (Source Greg Trainer, City Manager of Rangely).

300 gallons/person/day useage in Meeker (Source: Bob Young, City Manager of Meeker).

MGD = million of gallons per day, based on the trended population (Table 2-) and daily useage.

AMOUNT (%) OF WATER TREATMENT CAPACITIES USED BY THE TRENDED POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 2-6

Year	Rifle Sewage Generated	Rifle % Capacity	Rangely Sewage Generated	Rangely % Capacity	Meeker Sewage Generated	Meeker % Capacity
1980	2.63	26	1.97	49	1.95	49
1981	2.75	28	2.00	50	1.98	50
1982	2.86	29	2.03	51	2.01	50
1983	2.97	30	2.06	52	2.03	51
1984	3.08	31	2.09	52	2.06	52
1985	3.20	32	2.12	53	2.09	52
1990	3.76	38	2.27	57	2.24	56
1995	4.33	43	2.41	60	2.38	60
2000	4.89	49	2.56	64	2.52	63
2010	6.02	60	2.85	71	2.81	70

Note:

Sewage generated is in increments of 100,000 gallons per day.

AMOUNT (%) OF SEWAGE TREATMENT CAPACITIES USED BY THE TRENDED POPULATION IN RIFLE, RANGELY, AND MEEKER

TABLE 2-7

Year	Rifle Cubic yards generated	Rifle Acres required for disposal	Rangely Cubic yards generated	Rangely Acres required for disposal	Meeker Cubic yards generated	Meeker Acres required for disposal
1980	4,202	.87	3,151	.65	3,107	.64
1981	4,381	.91	3,198	.66	3,154	.65
1982	4,561	.94	3,245	.67	3,200	.66
1983	4,742	.98	3,290	.68	3,246	.67
1984	4,922	1.02	3,337	.69	3,293	.68
1985	5,102	1.05	3,385	.70	3,339	.69
1990	27,762	5.74	17,508	3.62	17,268	3.57
1995	32,263	6.67	18,673	3.85	18,418	3.81
2000	36,764	7.60	19,838	4.10	19,567	4.04
2010	87,030	17.98	43,180	8.92	42,589	8.80
Total	211,729	43.76	118,805	24.54	117,181	24.21
Present area	-	22.50	-	2.80	-	21.00
Area needed	-	21.26	-	21.74	-	1.79

Note: The assumptions are:

1. 3.5 lbs of trash/person/day.
2. 800 lbs of trash is equal to 1 cubic yard.
3. Ratio of volume to cover is 1:4.
4. Average depth of land fill is 15 feet.
5. Figures for 1985-1990, 1990-1995, 1995-2000 are 5 times the mean average of the 2 years.
6. Figures for 2000-2010 are 10 times the mean average of the 2 years.

The source for these assumptions is the Environmental Protection Agency's, "Sanitary Landfill Synoposizer."

SOLID WASTE DISPOSAL AREA NEEDED TO SATISFY TRENDED POPULATION IN RIFLE, RANGELY AND MEEKER

TABLE 2-8

Solid Waste Disposal

Presently, there is not adequate area in existing facilities to accommmodate solid wastes from the trended populations in Rifle, Rangely, and Meeker through 2010 (Tables 2-8). The facility serving Rifle would be full in about 1997. Rangely's disposal site would be at capacity in about 1984, while the Meeker facility would be full in about 2008. Rifle and Rangely would need an additional 21 acres of land to serve the trended population while Meeker would need another 2 acres.

Police and Fire Protection

Rifle has a police force of about 12 people and 7 cars. Rangely and Meeker both have approximately 4 police and 3 and 2 cars, respectively. To accommodate the trended population through 2010, Rifle would increase its force by 16 people and 9 cars. Rangely and Meeker would be enlarged by 2 people and 1 car each.

Volunteer fire fighters serve the three communities in the project area. Rifle and Rangely have about 25 each while Meeker has about 30. Rifle and Rangely also have 4 fire trucks each, while Meeker has 3. All of the communities have 2 ambulance/rescue units.

By about 2010, Rifle would need to add another 4 trucks to serve the trended population, in addition to a proportionate number of volunteers. Rangely would need to add 2 trucks and Meeker 1. Rangely and Meeker would also need to add another ambulance/rescue unit.

School Capacities

School capacities for the three communities are shown in Table 2-9. Based on trended population, no increase in the number of classrooms or schools would be required in Meeker or Rangely. Rifle, however, would need to increase the number of classrooms and schools as shown in Table 2-10.

Health Care System

All three communities in the project area have hospital facilities. The Rifle facility has about a 32-bed capacity while Rangely and Meeker have 28- and 17-bed capacities, respectively. Approximately 30 percent of this capacity is presently being utilized in Rifle, and about 45 percent in Rangely and Meeker. Maintaining the present level of service and assuming a 60 percent maximum utilization rate, Rangely has the capacity to serve the trended population through 2010. Both Rifle and Meeker would need to construct additional facilities by about 2000.

Lifestyles

This discussion on lifestyles is limited to those elements that would be affected by the proposed Superior project. A more thorough overview of lifestyles, and the socioeconomic component in general, is contained in the principal references for this section. These references are the two BLM socioeconomic profile documents (1976) and the BLM Planning Area Analysis (1978). Lifestyles described below are essentially those perceived by the people living in the area as reported in the reference documents.

A small town atmosphere and the physical environment are expressed as the primary advantages of living in the project area. The area is rural which, when compared to urban life, is relaxed and casual; a slower pace of life exists. There is a sense of independence, safety, and freedom. People are friendly and there is a feeling of solidarity. Ethics are toward work and self-reliance versus a speculator-type ethic. A speculator is one who engages in buying or selling a commodity with an element of risk on the chance of making a great profit. The social relationships, status levels, and community positions, which have developed over generations, form the backbone of the communities' self-identity.

Elements of the physical environment valued include the healthy climate and clean air and water. Also, the relative quietness and appearances of the towns are positive attributes of the area. Personal "psyche," or mental well-being, is improved by the wide horizon, vast expanse of space, clean air and water, and the open natural environment.

Some disadvantages of living in the area are a shortage of jobs and low wages. The cost of living is high and housing, at affordable prices, is in short supply. There is also a shortage of urban-type amenities such as shopping facilities and theatres, restaurants, and other forms of similar recreational opportunities.

Some limited growth is desired for economic health and the jobs that go with it. Jobs would allow more young people to stay in the area instead of migrating out. Retention of agriculture and its way of life is also desirable.

LAND OWNERSHIP AND USE

Land Ownership

Approximately 80 percent of Piceance Creek Basin is publicly owned and administered by BLM. The Colorado Division of Wildlife (DOW) owns the surface rights on nearly 15 percent of the approximately 850 square mile basin. Essentially all the minerals underlying the DOW land are in private ownership. The remaining 5 percent of the

Year	Rifle		Rangely		Meeker	
	Student Pop.	% Capacity	Student Pop.	% Capacity	Student Pop.	% Capacity
1980	1,477	83	588	49	649	54
1981	1,539	90	597	50	658	54
1982	1,603	94	606	51	668	55
1983	1,666	97	614	51	678	56
1984	1,730	101	623	52	687	57
1985	1,793	105	632	53	697	58
1990	1,980	116	676	56	745	62
1995	2,426	142	719	60	793	66
2000	2,744	160	762	64	842	70
2010	3,515	205	912	76	938	78

Note:

Student population is based on the assumption of maintaining 23 percent of the population as school age.

The areas of the school districts and their existing student capacities, as supplied by the Superintendent of each school district are:

Rifle = Rifle, Silt, Newcastle, and 20 percent of the balance of the county. Student capacity is about 1,710.

Rangely = Rangely and 40 percent of the balance of the county. Student capacity is about 1,200.

Meeker = Meeker and 60 percent of the balance of the county. Student capacity is about 1,210.

AMOUNT (%) OF SCHOOL CAPACITIES USED BY THE TRENDED POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 2-9

Year	Number Of Students Over Capacity	Classrooms Required	Schools Required
1984	30	1	-
1985	83	3	-
1990	270	11	1
1995	716	29	2
2000	734	29	5
2010	1,803	72	5

Note:

The figures represent an assumed 25 students per classroom and 15 classrooms per school.

PROJECTED CLASSROOMS AND SCHOOLS REQUIRED IN RIFLE TO ACCOMMODATE THE TRENDED POPULATION

TABLE 2-10

surface and mineral rights in the basin are owned by numerous private entities. Although BLM manages the majority of the basin, ownership patterns are scattered, and sometimes isolated, tracts. This condition exists in the project area as shown in Map 1-2, which is located in the pocket attached to the back cover.

Land Use

The primary use of the public land BLM manages is wildlife and livestock grazing. Ranchers are given permits for the purpose of grazing livestock on blocks of land, or allotments. Overall average forage production potential on suitable rangeland in the basin is about 12 acres per animal unit month (AUM). An AUM is the amount of forage required to sustain the equivalent of one cow or five sheep for one month. In the project area, it takes about 16 acres per AUM on land administered by BLM and 30 acres on DOW land.

DOW manages the land it controls for the benefit of wildlife. The State Fishing Area, located east of the proposed plant site (Map 1-2) is also administered by DOW. In addition to fishing, it provides associated recreation opportunity such as picnicking. Annual use of the area is about 10,000 people hours.

On the proposed project plant site (Map 1-2), Superior irrigates about 260 acres, which is about 1 percent of the approximately 26,000 acres of irrigated farmland in Rio Blanco County. Hay is the principal crop and is used for winter feeding of livestock. The 260 acres Superior cultivates, produces about 2 tons of hay per acre annually. There is no "prime," "unique," or "important" farmland in the area of the project site (*U.S. Soil Conservation Service, 1979*).

Transportation, powerlines, and pipelines rights-of-way are located in the project area (Map 1-2). State Highway 64 runs along the White River between Meeker and Rangely. Piceance Creek Road, or Rio Blanco County Road 5, parallels Piceance Creek. The county maintains unsurfaced roads in the area including the Yellow Creek Road shown in Map 1-2. Also shown in Map 1-2 are the alignments of the existing 6-inch diameter natural gas pipelines running generally north and south through the area and the east-west 138 kilovolt powerline.

Land Use Plans

BLM Management Framework Plan (MFP)

The White River MFP recommends that the lands proposed in the exchange be considered for trade (*BLM, 1978*). The rationale for the recommendation is that an economically minable unit, or consolidated "block" of land, is necessary for development and conservation of the resource.

Rio Blanco County Master Plan

The master plan for Rio Blanco County was adopted as a tool to help cope with possible energy related growth problems (*Rio Blanco Planning Commission, 1976*). The county has a high potential for growth centered around development of coal, oil shale, and oil and gas resources. Generally, the county's policy is to direct and maintain quality growth. The county program to assure such quality growth includes an impact assessment procedure which uses an impact document provided by a potential developer as a basis for decisions regarding re-zoning.

Other Plans

Garfield County has a master plan that was completed in 1968. A housing study is pending which would update that plan. Rangely's master plan was adopted in 1976 and serves as the guide for development in the community. Rifle and Meeker have each initiated comprehensive plans which should be complete in approximately one year. The Colorado Division of Wildlife and BLM have prepared the Piceance Basin Wildlife Habitat Management Plan. This plan outlines the goals of the two agencies in improving wildlife management in the area.

HIGHWAY SYSTEM

Use of the road segments within the project area is below their design capacities (Table 2-11). The locations of the road segments are shown in Figure 1-24. Capacity is defined as the number of vehicles, or volume, per hour at a given service level. A service level of "C" was used which means relatively unrestricted free flowing traffic able to average about 50 miles per hour during fair weather and daylight hours. No major road upgrades are planned.

Assuming the traffic generated per population and the mix of the number of cars versus trucks remains constant, the maximum peak hour of use would occur in approximately 2007. At that time State Highways 13 and 64 would be at 31 percent and 22 percent capacity, respectively. Piceance Creek Road would be at 18 percent of its capacity.

NOISE

The noise level at the project site is about 40 decibels (dba) based on representative levels according to population densities (*U.S. Department of Commerce, November 1977*). Existing traffic noise levels were determined based on the traffic volumes shown in Table 2-11. The number of vehicles by type class, heavy and medium trucks and autos,

		AVERAGE PEAK HOUR					MAXIMUM PEAK		
Year	Road Seg.	ADT	APH as % ADT	APH	CAP	APH as Coeff. of CAP	MPH as % ADT	MPH	MPH as Coeff. of CAP
1980	A	1,300	8	100	1,100	.09	16	210	.19
	B_1	300	1	30	500	.06	14	40	.08
	B_2	350	9	30	500	.06	14	50	.10
	C	1,350	8	110	1,100	.10	16	220	.20
	D	900	8	70	1,100	.06	16	140	.13
	E	600	9	50	820	.06	16	100	.12
	F	870	9	80	820	.10	16	140	.17
1985	A	1,500	8	130	1,100	.12	16	260	.24
	B_1	350	9	40	500	.08	14	60	.12
	B_2	400	9	40	500	.08	14	60	.12
	C	1,500	8	130	1,100	.12	16	260	.24
	D	950	8	80	1,100	.07	16	160	.15
	E	630	9	60	820	.07	16	110	.13
	F	910	9	90	820	.11	16	150	.18
1990	A	1,600	8	140	1,100	.12	16	280	.25
	B_1	450	9	40	500	.08	14	60	.12
	B_2	400	9	50	500	.08	14	70	.14
	C	1,600	8	140	1,100	.12	16	280	.25
	D	1,000	8	80	1,100	.07	16	160	.15
	E	660	9	60	820	.07	16	110	.13
	F	900	9	90	820	.11	16	160	.20
1995	A	1,750	8	140	1,100	.13	16	280	.25
	B_1	450	9	40	500	.08	14	60	.12
	B_2	500	9	50	500	.10	14	70	.14
	C	1,750	8	140	1,100	.13	16	280	.25
	D	1,050	8	80	1,100	.07	16	160	.15
	E	690	9	60	820	.07	16	110	.13
	F	990	9	90	820	.11	16	160	.20
2000	A	1,850	8	150	1,100	.14	16	320	.29
	B_1	550	9	50	500	.10	4	80	.16
	B_2	500	9	50	500	.10	14*	80	.16
	C	1,850	8	150	1,100	.14	16	320	.29
	D	1,100	8	90	1,100	.08	16	180	.16
	E	720	9	60	820	.07	16	120	.15
	F	1,050	9	90	820	.11	16	180	.22
2005	A	2,000	8	160	1,100	.15	16	320	.29
	B_1	600	9	50	500	.10	14	80	.16
	B_2	550	9	50	500	.10	14	80	.16
	C	2,000	8	160	1,100	.15	16	320	.29
	D	1,150	8	90	1,100	.08	16	180	.16
	E	750	9	70	820	.09	16	120	.15
	F	1,100	9	100	820	.12	16	180	.22
2007	A	2,100	8	170	1,100	.15	16	340	.31
	B_1	650	9	60	500	.12	14	90	.18
	B_2	600	9	50	500	.10	14	80	.16
	C	2,100	8	170	1,100	.15	16	340	.31
	D	1,200	8	100	1,100	.09	16	190	.17
	E	780	9	70	820	.08	16	120	.15
	F	1,150	9	100	820	.12	16	180	.22

NOTE: ADT = Average Daily Traffic
APH = Average Peak Hour Traffic
CAP = Capacity-Volume at Service Level "C"
MPH = Maximum Peak Hour Traffic the source for which is the State Department of Highway's "Colorado Traffic Volume Study", 1976, APH + MPH for Road Segments B_1 and B_2 are Estimated.

EXISTING AND TRENDED PEAK HOUR TRAFFIC VOLUME TO CAPACITY FOR ROAD SEGMENTS IN THE PROJECT AREA

TABLE 2-11

were calculated during the peak traffic hour. A graph, contained in the cited reference was used to find that the level would equal about 87 dba at 50 feet as the vehicles pass. The 87 dba is equivalent to a continuous pressure level, or L_{eq}, of about 52 dba. Based on the traffic shown in Figure 2-11, the L_{eq} for the road segments in the project area are shown in Figure 2-12.

VISUAL RESOURCES

Visual resources in the project area were analyzed using the Visual Resource Management System (VRM) described in BLM Manual Series 8400. VRM classes were assigned the area using an overlay mapping process that combines scenic quality, visual sensitivity levels, and distance zones. Scenic quality is a quantification of the physical appearance, or manifestation, of the landscape. Visual sensitivity levels are determinations of the importance the viewing public would assign the landscape. Distance zones are determinations of the distance between the area and the most important observer positions, or assessment points.

VRM classes are expressed in terms of how the landscape should be managed in order to protect the visual resource. The proposed plant site would fall within a Class II area where the management objective prescribes that landscape changes should not be evident and that a visual contrast may be seen but should not attract attention. The proposed portal site would be located within VRM III and IV areas. Management objectives for a Class III area are that changes are permitted if subordinate to the existing visual character. In Class IV areas, changes may dominate the existing visual character if similar to potential natural occurrences.

WILDERNESS VALUES

The wilderness inventory, in accordance with Section 603(a) of the Federal Land Management and Policy Act, has been completed on the public land that would be impacted by the proposal. This wilderness inventory is currently undergoing a 90-day public review with a final decision planned for issuance by the BLM-Colorado State Director in September, 1979. The area was found not to be roadless and therefore not to contain wilderness characteristics. In addition, the proposal would not affect any existing or potential wilderness areas, including those administered by other federal agencies.

CULTURAL RESOURCES

The National Register of Historic Places and supplemental listings were consulted (*U.S. Heritage Conservation and Recreation Service, 1979*). There are no sites on, or nominated to, the National Register Listing that would be affected by the proposed project.

Historic

There are 2 sites of local interest in the project area. White River City is located on private land near the White River (Map 1-2). The town was occupied in the 1880s. However, there is no apparent record of the town being plotted and filed with Rio Blanco County. All that remains on the site is scattered outbuildings and a house foundation.

An altar-type structure made of stacked rocks is located on public land overlooking Piceance Creek (*Price and Jennings, 1978*). As evidenced by a wooden cross about 2 feet in length, the site may have been a Christian shrine or monument.

The sites were evaluated for inclusion on the National Register and determined not eligible. The State Historic Preservation Officer concurred in this determination (*Townsend, 1978*).

Archaeological

All the acreage that BLM would exchange for private land with Superior, plus the 400 acres Superior would purchase from the Colorado Division of Wildlife, as designated on Map 1-2, has been surveyed for archaeological resources (*Buckles, 1974, and Price and Jennings, 1978*). Eight sites were located that appear to be eligible for the National Register, in accordance with 36 Code of Federal Regulations, Part 60 through 63 (36 CFR part 60-63).

CLIMATE AND AIR QUALITY

Climate

The climate of the project area is semi-arid, receiving an average of about 12 inches of precipitation each year (*U.S. NOAA, 1974 and U.S. Department of Commerce, 1968*). The frost-free period is about 60 days. Mean maximum temperature is about 90 degrees Fahrenheit, occurring in July, while the mean minimum temperature in January is about 4 degrees. Temperature inversions occur during about 75 percent of the nights throughout the year. Inversions are conditions where air temperature increases with increasing altitude, holding surface air down along with its pollutants.

Winds are predominantly from the southwest. At night, air cooling at the surface tends to flow downhill following the local drainage patterns. Channeling effects caused by the terrain result in persistent nighttime winds coming from the south, down the Piceance Creek Basin and into the project area. Winds in the White River Valley are strongly east-west oriented. Highest wind speeds

a. Decible (dba) at 50 Feet

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	65.5	65.9	66.2	65.7	66.0	66.2	66.6
B_1	52.6	53.7	53.7	54.2	54.8	54.8	55.1
B_2	51.2	52.6	53.7	53.7	54.2	54.8	54.8
C	63.9	64.4	64.7	65.2	65.4	65.8	67.0
D	64.9	65.4	65.7	66.0	66.2	66.4	66.6
E	63.3	63.9	64.1	64.3	64.5	64.8	64.9
F	64.2	64.4	64.7	65.0	65.2	66.2	65.4

b. Distance in Feet to the 50 dba Contour

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	300	315	320	310	315	315	340
B_1	65	80	80	85	90	90	95
B_2	60	65	80	65	85	90	90
C	250	270	280	290	300	310	350
D	275	270	310	315	315	340	340
E	230	250	250	280	270	280	280
F	255	270	280	290	290	315	270

EXISTING AND TRENDED NOISE LEVELS IN THE PROJECT AREA

TABLE 2-12

Pollutant	Standards: Federal (Primary)	Standards: Federal (Secondary)	Standards: State	Exist. Levels at the Site
Sulfur Oxides				
Annual	80	-	-	10
24-Hour	365	-	-	133
3-Hour	-	1,300	700	218
Nitrogen Oxides				
Annual	100	100	100	10
Non-Methane Hydrocarbons				
3-Hour (6-9 a.m.)	160	160	-	220
Oxidant (Ozone)				
1-Hour	235	235	235	180
Carbon Monoxide				
8-Hour	10,000	10,000	10,000	4,400
1-Hour	40,000	40,000	10,000	5,300
Total Suspended Particulates				
Annual	75	60	75	11
24-Hour	260	150	260	11

Note: The existing level of non-methane hydrocarbons presently exceeds Federal guidelines.

The gaseous pollutant levels were projected from data taken at Oil Shale Tract Ca (Gulf Oil-Standard Oil, 1976).

Total Suspended Particulates levels were taken from Oil Shale Tract Cb (Ashland Oil-Occidental Oil, 1977). The annual level is based on geometric means and the 24-hour level is arithmetic.

AIR QUALITY STANDARDS AND PROJECTED AMBIENT LEVELS OF POLLUTANTS AT THE PROPOSED SUPERIOR OIL PROJECT SITE ($\mu g/m^3$)

TABLE 2-13

ordinarily occur in the late morning and lowest speeds occur during the early morning hours (*CDM Environmental Sciences Division, 1978*).

Air Quality

Projected current ambient level of pollutants in the project area are shown in Table 2-13. Currently, guidelines established for non-methane hydrocarbons are exceeded at the proposed project site. The source of these concentrations is not specifically known.

Average visibility is between 70 and 75 miles with maximum visibility of 150 miles (*Ashland Oil-Shell Oil, 1976*). Maximum visibility occurs more frequently during the winter months when the particulate loading of the atmosphere is the lowest because of snow cover and generally frozen conditions.

GEOLOGY

Geology and Minerals

Piceance Creek Basin is structurally a broad basin that was part of a lake system that extended into Wyoming and Utah 36 to 58 million years ago. The geologic history of the basin is contained in the primary references for this discussion (*U.S. Geologic Survey, 1961, and Rocky Mountain Association of Geologists, 1974*).

The basin, as outlined in Map 1-1, is about 850 square miles in area. Characterizing the area are extensive plateaus rising between approximately 1,000 to 4,000 feet above surrounding lowlands. The drainage system consists of deeply cut valleys, or canyons, with flat alluvial-filled bottoms. Elevation of the area ranges from about 9,000 feet near the southern boundary of the basin to about 6,000 feet on the northern edge and in the area of the proposed project (Map 1-2).

More than 2,500 feet of oil shale, sandstone, siltstone, and shale have been deposited in the basin containing approximately 1,200 billion barrels of oil equivalent. At the current rate of the U.S. consumption, this is about a 200 year supply of oil. The succession of deposited strata, or layers, are mapped as the Green River and Uinta formations. In the project area, the Green River formation is further divided, from bottom to top, into the Garden Gulch and Parachute Creek members as shown in Figure 1-12. The Garden Gulch member consists of fine grained and fragmented clay shale, mudstone, and siltstone grading into the overlying Parachute Creek member. Oil shale composes most of the Parachute Creek member. The formation dips an average of 14 degrees from the proposed project mine portal and continues to dip, more gently however, towards the center of the basin.

The Uinta formation forms the surface rock over most of the basin. The formation contains sandstone, siltstone, and marlstone.

The major oil shale bearing Parachute Creek member is deepest near the center of the basin at 2,000 feet. Three zones occur within the member; mahogany zone, leached zone, and lower zone. The richest oil shale is contained in the mahogany zone which is more than 600 feet thick in the southern part of the basin but thins out along the northern boundary and, specifically, in the project area.

Nahcolite originally deposited in the area of the leached zone has been dissolved and removed by ground water. The zone is characterized by solution cavities and open fractures filled with saline water. While limits of the zone are not sharply defined, the estimated extent of the zone is shown in Figure 2-1. The zone does not outcrop in the southern part of the basin and in only a small area in the northern part.

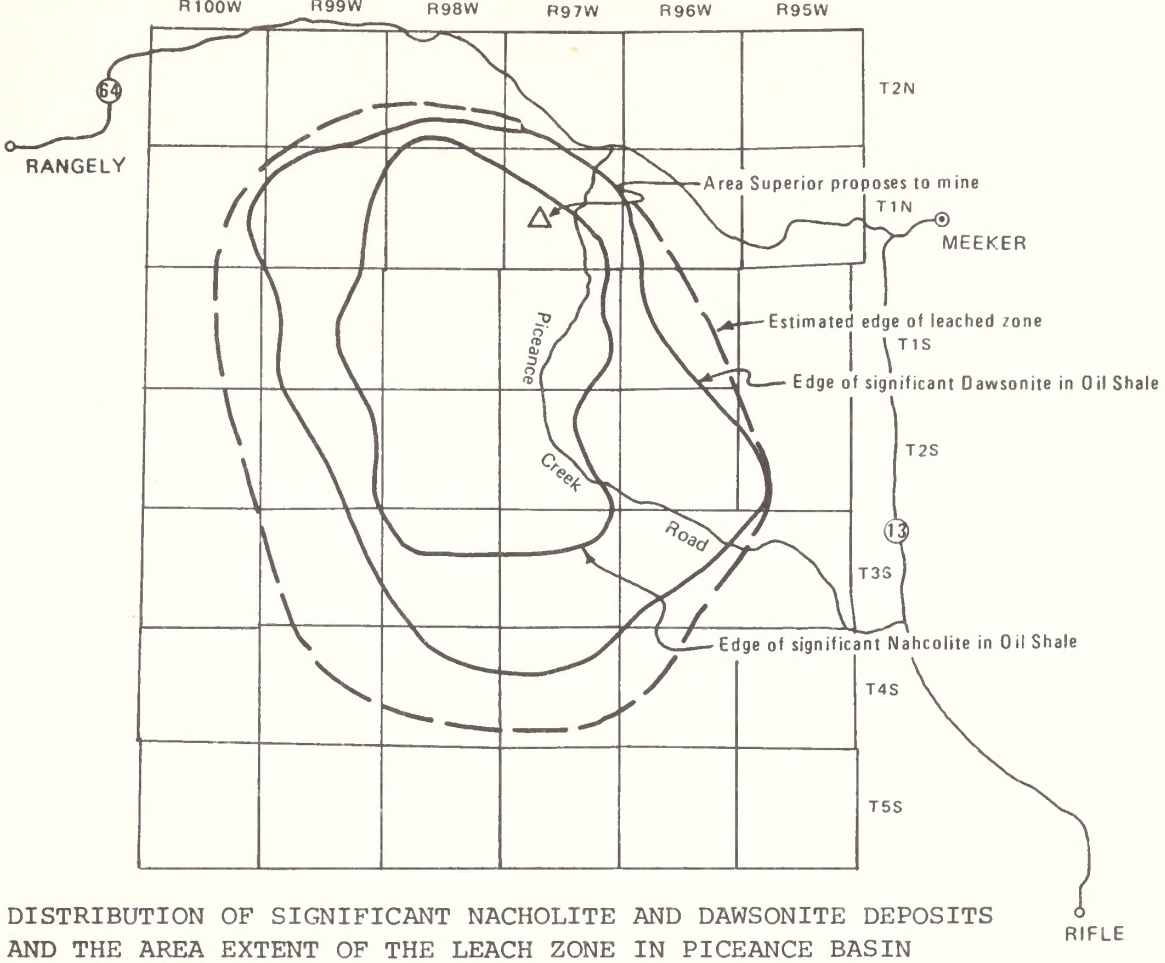
The lower zone is an area of unfractured oil shale containing the minerals nahcolite and dawsonite. Except for the northern edge of the basin, and the site of the proposed mine, the zone is restricted to the subsurface. Nahcolite bearing oil shale gradually thins and eventually disappears outward from the center to the margins of the basin. Dawsonite has a greater lateral and vertical distribution as shown in Figure 2-1. Approximately 19 billion tons of dawsonite, or 6.5 billion tons of alumina, and 29 billions tons of nahcolite occur in the basin.

The USGS (1976) reports that the recoverable mineral reserves on the approximately 2,572 acres of private land Superior proposes to exchange are about 412 million barrels of shale oil, 19 million tons of nahcolite, and 12.7 million tons of alumina. Soda ash is derived from residual nahcolite in the oil shale and from dawsonite. On the 2,045 acres of public lands that would be involved in the exchange the reserves are 317.5 million barrels of shale oil, 27 million tons of nahcolite, and 9.8 million tons of alumina.

Seismology

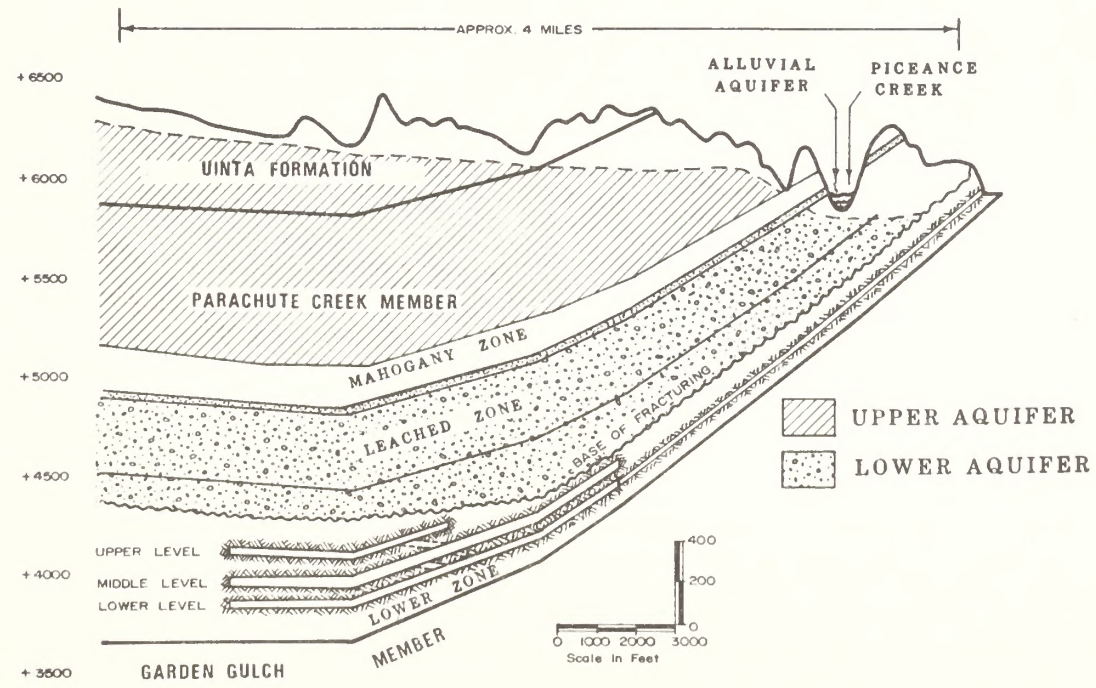
No active surface faults are located within or near the project area. An extensive system of joints, or fractures, exists in the rock mass; however, no appreciable movement has occurred. Jointing is highest in the Uinta formation and in the upper part of the Parachute Creek member. In the more plastic mahogany and lower zones, joints are more poorly developed.

Piceance Creek Basin is in a region of low seismicity or earthquake occurrence (*Simon, 1972*). In the project area earthquakes may be felt but



DISTRIBUTION OF SIGNIFICANT NACHOLITE AND DAWSONITE DEPOSITS AND THE AREA EXTENT OF THE LEACH ZONE IN PICEANCE BASIN

FIGURE 2-1



CROSS SECTION VIEW OF THE AQUIFER SYSTEM

FIGURE 2-2

damage would be minor. The seismic frequency is about one or less per decade per square degree of latitude and longitude. Within a 150-mile radius, the largest earthquake recorded occurred about 140 miles away and had an intensity of VI on the Modified Mercalli Scale, which means it would be felt by all people but damage would be slight.

Paleontology

In the project area, fossils of fly larvae and minute freshwater crustaceans are found in the Garden Gulch member of the Green River formation (*U.S. Geological Survey, 1967*). Fish scales are also contained in the Garden Gulch as well as in the Parachute Creek member. Leaves are found in the Uinta formation and plant fragments are in both formations. Also embodied within the Parachute member and Uinta formation are insect and insect larvae fossils. All of these fossils are duplicated throughout the Piceance Basin and other areas.

All fossils have some scientific value for such purposes as geologic age correlation and as indicators of past environmental conditions. Those known fossils contained within the project area have no exceptional scientific interest or value.

WATER RESOURCES

Water Quantity

The water system in the project area consists of the lower, upper, and alluvial aquifers and the Piceance Creek and White River (*USGS, 1974*). The relative locations of these aquifers are shown in Figure 2-2.

The mahogany zone separates the lower and upper aquifers. In the project area, water moves up from the lower aquifer through the less permeable mahogany. Up to 25 million acre-feet of water is estimated to be stored in the aquifers in an equilibrium state; with an annual 26,100 acre-feet being discharged and the same amount being recharged. Approximately 82 percent of the water, which amounts to about 21,400 acre-feet per year or 1,780 per month, discharges into Piceance Creek as stream flow or is evaporated. An acre-foot is equal to about 325,850 gallons.

The alluvial aquifer in the project area is limited to the valley bottom along Piceance Creek and its tributaries. Depth of the water-saturated alluvium ranges from about 100 feet, approximately 3 miles upstream of the proposed plant site, to less than 20 feet at the site of the proposed dike as shown in Map 1-2 (*Thompson Inc., 1974*). Water is transmitted through the aquifer at a maximum rate of about 20,000 square feet per day, which calculates to about 300 gallons per minute.

Flow rates and volumes for Piceance Creek and White River are shown in Table 2-14. The 100-year flood flow in Piceance Creek would be about 4,310 cubic feet per second (cfs) (*Peake One Co., 1974*). A 100-year flood is defined as the flood level which has a 1 percent chance of occurring in any given year.

Water Quality

Concentrations of total dissolved solids (TDS) in the lower aquifer exceed 30,000 parts per million, or milligrams per liter (mg/l). The dissolved solids are primarily nahcolite, or sodium bicarbonate. Since the mahogany zone impedes the water movement, the upper aquifer has a lower TDS which is about 2,000 mg/l. TDS concentration in the alluvial aquifer is about 3,350 mg/l. Based on data collected by Superior Oil, the TDS concentration in Piceance Creek, near the confluence is about 2,270 mg/l and about 635 mg/l in the White River below the mouth of Piceance Creek.

The average suspended sediment carried by Piceance Creek is about 530 mg/l or approximately 13,000 tons per year. This quantity was derived by averaging data presented by the U.S. Geological Survey's annual "Water Resource Data for Colorado." The White River carries about 5,800 tons annually (*U.S. Geological Survey, 1974*).

Water Rights and Use

Superior has irrigation water rights on Piceance Creek and the White River for 15 cfs and 5cfs, respectively. The Piceance Creek rights have adjudication dates of 1929, 1942, and 1958, while the White River right has a date of 1942. Among other rights, Superior has a 12 cfs conditional decree, dated 1968, on the White River for other beneficial uses and underground well permits for the lower aquifer, totaling about 20,000 gallons per minute or 32,000 acre-feet.

The water is used to irrigate approximately 260 acres of hay at the proposed plant site. Water from Piceance Creek is diverted about 3 miles upstream of the proposed portal area and is carried in a ditch by gravity. A pump, located near the Piceance Creek Road bridge aross the White River (Map 1-2), draws water from the White River which is carried to the hay fields in a 12-inch diameter pipe. The water from Piceance Creek and the White River is mixed before being applied to improve the overall quality, since the water from Piceance Creek contains TDS concentrations of about 1,700 mg/l at the point of diversion. About 275 acre-feet of water is consumed annually.

	Ave. Flow (cu'/sec)	Max. Flow (cu'/sec)	Min. Flow (cu'/sec)	Ave. Volume (ac. ft.)
Piceance Creek	24	407(1966)	0.5(1966)	17,320
White River #1	628	4370(1975)	140(1966)	455,000
White River #2	685	4260(1975)	250(1972)	497,000

Note:

Piceance Creek was measured near the confluence with the White River.

White River #1 was measured about 10 miles down-stream of Meeker.

White River #2 was measured about 5 miles upstream of Rangely.

Source = U.S. Geological Survey, "Water Resource Data for Colorado, Water Year 1976."

cu'/sec = cubic feet per second -- 7.48 gallons
ac. ft. = acre feet -- 325,850 gallons

AVERAGE ANNUAL FLOW AND VOLUME OF THE PICEANCE CREEK AND WHITE RIVER
(Rounded Figures)

TABLE 2-14

SOIL

Soils in the project area occur predominately on terraces, valley walls, and flood plains. They have formed, and are forming, from shales and sandstones. Map 2-1, located in the packet attached to the back cover, shows locations and gives general physical and chemical interpretative information for soils in the project area. Additional information is available from the Soil Conservation Service reference shown in Map 2-1.

VEGETATION

General Vegetation

Vegetation in the project area is divided into seven communities, or types, as shown in Map 2-1, which is located in the packet attached to the back cover, (*BLM, 1978*). The uplands support a pinyon-juniper (PJ) community. Generally, the PJ growth is dense, especially on the more level sites. At the southern edge of the project site the PJ has been chained, or mechanically uprooted, to increase livestock forage. Following chaining, shrubs, grasses, and forbs have become predominate.

The PJ community blends into the sagebrush community. Sagebrush and greasewood grow in association with one another; however, as the salinity of the soil increases adjacent to Piceance Creek, greasewood becomes dominate and replaces sagebrush completely.

Highly saline soils adjacent to Piceance Creek are nearly barren except for the occurrence of saltgrass. Cropland has been developed along the White River. Meadow hay and alfalfa are irrigated with water from Piceance Creek and the White River. A riverbottom community grows along the banks of the White River. Cottonwood trees, associated with willow and salt cedar, dominate this community.

The proposed project is within the BLM Piceance Planning Unit. In the approximately 800,000 acre unit, there are approximately 250,000 acres of PJ, 260,000 acres of sagebrush, 5,000 acres of greasewood, 43,000 acres of barren or waste, 4,000 acres of cropland, and 10,000 acres of river bottom.

Endangered and Threatened Species

In the project area, a specific inventory for plant species proposed for endangered and threatened status (*U.S. Fish and Wildlife Service* [*FWS*], *1976*) has not been undertaken. Four species proposed for endangered status occur in Rio Blanco County; feverfew, debris milkvetch, wild buckwheat (*FWS, 1978*), and a species of fescue (*BLM, 1978*).

WILDLIFE

General Wildlife

Piceance Creek Basin supports a wide variety of wildlife. The references for this section contains a thorough listing and description of the wildlife in the area (*Craig and McKean, 1977, Baker and McKean, undated, BLM and DOW, 1977, BLM, 1978 and 1979, and Environmental Impact Analysis, Inc., 1974*). The mule deer is the most conspicuous or important species in terms of economic value and potential impacts from the proposed action. Approximately 35,000 deer use the Piceance Basin for winter range, with a density of about 52 deer per square mile in the project area. Winter concentration areas, which encompass a portion of the area, have population densities of up to 80 per square mile (*BLM, 1978*).

An average of about 10 percent of the herd, or 3,500 deer, die each year from starvation and other winter related causes. Another approximately 3,000 are harvested each year by hunters. In Rio Blanco County, about 600 are killed as a result of collisions with vehicles on highways. This number is based on recorded kills, between 1968 and 1970, of 338 which represents about 55 percent of the total number (*Jump and McKean, 1977*).

In the project area, Piceance Creek does not support a sports fishery. Species diversity and abundance is limited primarily by water quality (*C-b Shale Oil Venture, 1977, U.S. Environmental Protection Agency, 1973, and Thorne Ecological Institute, 1974*). Typical fish species include the speckled dace, white suckers, and fathead minnows.

Endangered and Threatened Species

There are 14 wildlife species listed as endangered or threatened (T&E) by the U.S. Fish and Wildlife Service (1977) and Colorado Division of Wildlife (1978). Only two species are known to occur in the project area which would be affected by the proposal; the bald eagle and Colorado River squawfish. Bald eagles winter along the White River. The squawfish has been collected in the White River near its confluence with Piceance Creek.

The Fish and Wildlife Service, in accordance with Section 7 of the Endangered Species Act, and the Colorado Division of Wildlife were consulted regarding possible effects of the proposed action on the T&E species. It was determined that the project would not adversely impact the species (*U.S. Fish and Wildlife Service, 1978*).

Wild Horses

There are approximately 40 wild horses that range within a 12,700 square mile area encompassing the project area. Of this number, a maximum of 15 horses use the project area as home range and restrict their habitat to the higher pinyon-juniper covered plateaus. The avoidance reaction of the horses to human activity, and the access barriers presented by the high bluffs, would effectively shield the horses from potential impacts from the proposed project.

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

Effects of interrelated projects, as described in Chapter 6, are not analyzed here. This chapter describes the significant environmental impacts that would occur with implementation of the proposed Superior Oil project only. Presented are the results of an impact analysis based on the cause/effect relationship of the proposed project, as described in Chapter 1, and the existing environment, as described in Chapter 2. In the discussion, the effects on the individual resource components and subcomponents are first tabulated. Effects on other resource components are also identified. Bottom-line impacts are then discussed in the subsections entitled Ultimate Effects.

The principal basis for the analysis itself is the professional judgements of the resource specialists that prepared this document. A range of probability that the impact would occur has been used when appropriate. The range is defined in terms of percentage: 10-29 percent--the impact is considered highly unlikely to occur; 30-59 percent--the impact would not likely occur; 60-79 percent--the impact would probably occur; and, 80-100 percent--is highly probable. A percentage probability figure will be set in parenthesis with the discussion of each impact.

SOCIOECONOMICS

Superior's proposed employment (Table 1-2) and income (Table 1-3) would result in new demands for goods and services in the project area. These "demands" would produce additional employment, termed non-basic, to serve the needs. Together, the two types of employment would generate a new population in the area which would be distributed among three counties--21 percent in Garfield County, 65 percent in Rio Blanco County, and 14 percent in Mesa County. The foundation for the population analysis is the Colorado West Area Council of Governments (*CWACOG, 1977*).

In the impact analysis, only those effects on Rifle, Rangely, and Meeker are discussed. Approximately 75 percent of the total new population would reside in these communities. The remaining 25 percent would be so widely distributed over the area or in more heavily populated communities, such as Grand Junction, that the effect would be insignificant and not traceable.

The new population would require housing and community services which would directly cause impacts and also affect public finances. Effects on public finances are analyzed, based on the costs of providing the community services, compared to the expected new revenues from sources such as sales and property taxes. In the analyses, the level of community services was assumed to stay the same as currently exists in the area, and the increment above trended needs is all that is assessed.

The full effect of the new population and corresponding requirements for housing and community services would be realized as an effect on the lifestyles of the people. Lifestyles are the consistent ways of life, or style of living, that reflects the attitudes and values of the people living in the communities.

Employment, Income, and Population

Employment and Income

Superior's proposed employment is shown in Table 1-2. The number of those employees that would live in Garfield and Rio Blanco Counties is shown in Table 3-1. Non-basic employment would occur to supply goods and services to the proposed project and its employees and their families. Table 3-2 shows the number of non-basic employees that would live in the two counties. The total number of employees, Superior plus non-basic, is shown in Table 3-3 by residence.

The average annual income of the proposed Superior employees is shown in Table 1-3. These incomes would be distributed within the counties and communities as shown in Table 3-4. Annual incomes of the non-basic workers and total income figures are shown in Tables 3-5 and 3-6, respectively.

Population

Projected new populations for Garfield and Rio Blanco Counties are shown in Table 3-7 and are further broken down by communities in Table 3-8. The new populations were assumed to be made up of people that would migrate in from outside the

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	4	3	14	3	10
1981	11	8	34	6	25
1982	56	38	173	33	133
1983	96	64	298	55	229
1984	179	119	551	102	369
1985	277	185	858	158	660
1986	275	183	851	157	656
1987-2006	194	129	598	110	460
2007	150	100	462	85	355
2008	11	7	33	1	25

NUMBER OF PROPOSED SUPERIOR OIL EMPLOYEES BY RESIDENCE

TABLE 3-1

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	3	2	11	2	8
1981	9	6	27	5	20
1982	45	30	138	26	106
1983	77	51	238	44	183
1984	250	167	496	92	382
1985	388	259	772	142	594
1986	385	256	766	141	590
1987-2006	271	186	538	99	414
2007	209	140	415	76	320
2008	15	10	29	5	23

NUMBER OF NON-BASIC EMPLOYEES BY RESIDENCE

TABLE 3-2

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	7	5	25	5	18
1981	20	14	61	11	45
1982	101	68	311	59	239
1983	173	115	536	99	412
1984	429	286	1,047	194	751
1985	665	444	1,630	300	1,254
1986	660	439	1,617	298	1,246
1987-2006	465	310	1,136	209	874
2007	359	240	877	161	675
2008	26	17	62	6	48

TOTAL NUMBER OF PROPOSED SUPERIOR OIL AND NON-BASIC EMPLOYEES BY RESIDENCE

TABLE 3-3

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	78,828	59,121	256,191	39,414	197,070
1981	219,780	139,860	659,340	119,880	499,500
1982	1,136,464	750,878	3,510,862	649,408	2,699,102
1983	1,891,776	1,261,184	5,872,388	1,083,830	4,512,674
1984	3,374,702	2,256,121	10,446,409	1,933,818	8,038,616
1985	5,348,870	3,572,350	16,567,980	3,050,980	12,744,600
1986	5,193,100	3,455,772	16,089,168	2,964,788	12,369,020
1987-2006	3,092,053	2,066,709	9,580,588	1,762,310	7,369,660
2007	2,379,071	1,586,047	7,363,791	1,359,469	5,664,455
2008	179,798	119,865	556,520	102,742	428,092

Note:

An equal distribution per skill category is assumed.

TOTAL ANNUAL INCOME OF THE PROPOSED SUPERIOR OIL EMPLOYEES BY RESIDENCE (1977 DOLLARS)

TABLE 3-4

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	38,487	25,658	141,119	25,658	102,632
1981	115,461	76,974	346,383	64,146	256,580
1982	577,305	384,870	1,770,402	333,554	1,359,874
1983	987,833	654,279	3,053,302	564,476	2,347,707
1984	3,207,250	2,142,443	6,363,184	1,180,268	4,900,678
1985	4,977,652	3,322,711	9,903,988	1,821,718	7,620,426
1986	4,725,621	3,144,752	9,617,764	1,769,070	7,400,196
1987-2006	3,476,659	2,322,049	6,902,002	1,270,071	5,311,206
2007	2,681,261	1,796,060	5,324,035	975,004	4,105,280
2008	192,435	128,290	372,041	64,105	295,067

Note:

The average annual salary for non-basic employees is $12,829 based on information contained in "Colorado Statistics of Income 1977" as prepared for the Colorado Legislative Council (Research Publication No. 230) in 1977.

TOTAL ANNUAL INCOME OF NON-BASIC EMPLOYEES BY RESIDENCE (1977 DOLLARS)

TABLE 3-5

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	117,315	84,779	397,310	65,072	299,702
1981	335,241	216,834	1,005,723	184,026	756,080
1982	1,713,769	1,135,748	5,281,264	982,962	4,058,976
1983	2,879,609	1,915,463	8,925,690	1,648,306	6,860,381
1984	6,581,952	4,398,564	16,809,593	3,114,086	12,939,294
1985	10,326,522	6,895,061	26,471,968	4,872,698	20,365,026
1986	9,918,821	6,600,524	25,706,932	4,733,858	19,769,216
1987-2006	6,568,712	4,388,758	16,482,560	3,032,381	7,900,786
2007	5,060,332	1,924,350	12,960,826	2,334,473	9,769,735
2008	372,233	248,155	928,561	166,887	723,159

TOTAL ANNUAL INCOME OF PROPOSED SUPERIOR AND NON-BASIC EMPLOYEES BY RESIDENCE (1977 DOLLARS)

TABLE 3-6

Year	New Garfield County Population				New Rio Blanco County Population			
	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.
1980	22,122	8	9	22,140	5,379	26	26	5,431
1981	23,070	21	23	23,114	5,459	65	64	5,589
1982	24,018	112	120	24,251	5,539	348	343	6,229
1983	24,966	193	207	25,366	5,619	598	591	6,808
1984	25,916	358	609	26,881	5,698	1,107	1,229	8,034
1985	26,862	557	956	28,375	5,778	1,725	1,915	9,418
1990	31,603	388	666	32,657	6,177	1,202	1,335	8,713
1995	36,343	388	666	37,397	6,575	1,202	1,335	9,112
2000	41,083	388	666	42,137	6,974	1,202	1,335	9,510
2010	50,563	233	400	51,196	7,771	721	801	9,293

Note:

Basic employment is that directly associated with the proposed Superior Oil Project.

By the year 2010, approximately 40 percent of Superior Oil and directly related non-basic employees have been assumed to migrate out of the area.

PROJECTED NEW POPULATIONS FOR GARFIELD AND RIO BLANCO COUNTIES WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-7

Year	New Rifle Population				New Rangely Population				New Meeker Population			
	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.
1980	2,633	6	6	2,644	1,974	5	5	1,984	1,947	20	20	1,987
1981	2,745	14	14	2,773	2,004	12	12	2,028	1,976	50	50	2,076
1982	2,858	75	74	3,007	2,033	66	65	2,164	2,005	265	262	2,532
1983	2,971	129	127	3,227	2,062	114	113	2,289	2,034	457	450	2,941
1984	3,084	238	412	3,734	2,091	211	234	2,536	2,064	845	938	3,846
1985	3,197	371	642	4,210	2,121	329	365	2,815	2,092	1,316	1,462	4,870
1990	3,761	259	447	4,467	2,267	229	255	2,751	2,236	918	1,018	4,172
1995	4,325	259	447	5,031	2,413	229	255	2,897	2,380	918	1,018	4,316
2000	4,889	259	447	5,595	2,559	229	255	3,043	2,524	918	1,018	4,460
2010	6,017	155	268	6,440	2,852	137	153	3,142	2,813	551	611	3,975

Note:

Basic employment is that directly associated with the proposed Superior Oil project.

PROJECTED NEW POPULATIONS FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-8

area. Superior proposes to hire locally where possible; however, it is not possible to quantify this "local" employment. By assuming all new people, the range of possible impacts is maximized.

As reflected in the projected population tables, approximately 60 percent of the new people were assumed to remain in the area following abandonment of the Superior project. The major rationale behind this assumption is that the region contains considerable energy resources, including oil shale, coal, natural gas, and oil that would ultimately be developed and provide a continued livelihood for the Superior and non-basic employees. Such a phenomenon of apparent "temporary" people not outmigrating is reported in Mountain West Research, Inc. (1975).

Ultimate Effects

Superior proposes to pay an average annual wage of about $17,200 (Table 1-3) and the non-basic employees would earn an estimated $12,830 annually (Table 3-5). These incomes are significantly higher than the average $10,850 currently being earned in the two counties (Table 2-1). As a result of these new higher wages, people would be drawn into the new employments and into the area from other jobs in the region, causing a disruption of other industries. The existing economy would change, thereby affecting lifestyles. This effect on local economies would be slightly mitigated due to the availability of new family members to fill some local jobs such as in the service industry.

The higher wages would drive up all wages while, at the same time, inflate the costs of goods and services, including housing. With income as the indicator, the overall average standard of living in the area would be increased (80 percent probability). However, this increase would not be equally distributed. Those on a fixed income, such as those who are retired, on welfare, and government workers, would be forced to spend a greater proportion of their money for subsistence--primarily food and housing. The impact on these people would be a lowering in the quality of life by no longer being able to afford "luxuries" (70 percent probability), or by being forced to leave the area entirely (20 percent probability).

Local businesses would benefit financially from the prosperity that would be created by the high demand for the goods and services available in the area. The new increased population and increased disposable incomes would produce a need to expand existing businesses and also attract new businesses. While most businesspeople would benefit, some local people would ultimately be forced out of business because they would be unable or unwilling to expand to accommodate the new increased demands and different buying preferences of the new population (40 percent probability). Some people would be forced out of business because of overwhelming competition from larger franchises and other larger operations (50 percent probability).

Housing

The housing requirements of the new populations for Rifle, Rangely, and Meeker (Table 3-8) are shown in Table 3-9. Projected types and numbers of dwelling units that would satisfy these requirements are shown in Table 3-10.

Ultimate Effects

Housing demand for the Superior population would stabilize by about 1990 (Table 3-9). Up to that time competition for housing would increase the cost of buying that housing. Not only would the price be inflated but the cost of financing would also increase because of shorter loan repayment terms and competition for the available financing monies. Loan terms would be shorter in that they would correspond to the relatively short duration of the project (Figure 1-3). As expressed in the previous section on employment, income, and population, those on fixed incomes would feel the greatest impact.

It is assumed developers would react to housing demand rather than anticipate it. Therefore, housing construction would lag behind demand. Mobile homes and temporary housing, such as campers, would be used. Those forced to take this course of action would experience a decrease in their quality of life. Some would be separated from families or be living in an unstable "transient" type of living arrangement. The effect on the communities would be an increased cost of providing community services without gaining the full amount of revenue from these people to support their share of the cost (60 percent probability).

Sprawl, which is building housing on the outskirts of the towns, would not only reduce environmental quality of the area but would also increase the cost of providing community services by as much as 20 percent. In Rio Blanco County the probability of this occurring is low (10 percent) because the county has demonstrated a strong stand against such development, which is expected to continue. However, in Garfield County the probability is higher (55 percent). The reason for this is that the county is working with an outdated master plan and is faced with relatively higher priority, more pressing, problems in other parts of the county.

By about 2010, when the project is complete and 40 percent of the new population migrates out, approximately 450 housing units would be vacated.

Number of Dwelling Units (DU) Required by Community

Year	Rifle Trended DU	Rifle Superior DU	Rifle Total DU	Rangely Trended DU	Rangely Superior DU	Rangely Total DU	Meeker Trended DU	Meeker Superior DU	Meeker Total DU
1980	41	4	45	9	3	12	10	15	25
1981	40	6	46	10	5	15	11	22	33
1982	41	44	85	9	34	43	9	159	168
1983	41	39	80	9	30	39	10	140	150
1984	41	141	182	10	68	78	11	325	336
1985	41	21	62	9	13	22	11	57	68
1990	203	-	203	45	-	45	54	-	54
1995	204	-	204	44	-	44	58	-	58
2000	203	-	203	47	-	47	53	-	53
2001	407	-	407	93	-	93	107	-	107
Total	1,262	255	1,517	285	153	438	334	718	1,052

Note: The source for Trended D. U. is Table 2-4

PROJECTED NEW HOUSE REQUIREMENTS FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-9

Number of single unit (SUD), multiple unit (MUD), mobil home (MH), and temporary (temp.) dwellings by community.

Year	Rifle SUD	Rifle MUD	Rifle MH	Rifle TEMP.	Rangely SUD	Rangely MUD	Rangely MH	Rangely TEMP.	Meeker SUD	Meeker MUD	Meeker MH	Meeker TEMP.
1980	29	5	11	-	9	1	2	-	19	3	4	-
1981	30	5	12	-	11	2	2	-	24	3	6	-
1982	55	8	21	-	32	4	7	-	124	17	27	-
1983	52	8	20	-	29	4	6	-	111	15	24	-
1984	118	18	46	-	58	8	12	-	249	33	54	-
1985	40	6	16	89	16	2	4	65	50	7	11	312
1990	132	20	51	-	33	5	7	-	40	5	9	-
1995	133	20	51	-	33	4	7	-	43	6	9	-
2000	132	20	51	-	35	5	7	-	39	5	9	-
2010	265	41	101	-	69	9	15	-	79	11	17	-
TOTAL	986	151	380	89	325	44	69	65	777	105	170	312

PROJECTED TYPE OF DWELLING UNITS REQUIRED FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-10

This would lower the overall value of all housing in the communities, plus decrease the value of the investment of those leaving (80 percent probability). While the severity of the devaluation is not known, the probability is high (85 percent probability) that the future availability of housing at the end of the project would be anticipated and new housing construction rates adjusted accordingly. Some of the people remaining would take advantage by "moving up" to better accommodations during this time and thereby increasing their quality of life.

Community Services

Water Treatment Facilities

Currently there is treatment capacity in the Rifle and Rangely water treatment facilities to accommodate the projected new population (Table 3-11). By 1985, a shortage of about .24 million gallons-per-day treatment capacity would exist in Meeker. However, the Meeker plant is sized to allow doubling of the capacity to 2.4 million gallons at a relatively low cost of about $648,000. Assuming that this doubling of capacity would occur in 1985, the effect would be on public finance. The flow of the White River would be affected by increased water usage in Meeker and Rangely, which is discussed in the Water Resources section of this chapter.

Sewage Treatment Facilities

As shown in Table 3-12, the capacity for sewage treatment in Rifle and Rangely would not be exceeded with the proposed project. By 1985, the capacity of the treatment facility in Meeker would be exceeded, necessitating the enlargement of the plant. The effect of this enlargement would be on public finances.

Solid Waste Disposal

The quantity of waste that would be generated at the proposed project site is shown in Table 1-5. The volume and acreage required for disposal is shown in Table 3-13. Superior proposes to haul its waste to the Meeker site for disposal. However, it is the policy of Rio Blanco County that developments such as Superior's dispose of their waste in sites other than the county facility; which Superior must do. The resolution to this circumstance is addressed in Chapter 4, Mitigation.

The new population (Table 3-8) would cause the Rifle and Rangely disposal sites to be at capacity about one year earlier than would occur with the trended population only, as shown in Table 2-8. Meeker's site would be full about 12 years earlier--1996 versus 2008. Within the time frame of the Superior proposal, an additional 6.7, 4.7, and 19.1 acres would be required for solid waste disposal in Rifle, Rangely, and Meeker, respectively, when compared to that required for the trended population only (Table 2-8).

Police and Fire Protection

By about 2010, Rifle would need about 28 policemen and 16 cars to maintain the current level of service to the trended population only. With the proposed action, Rifle would need 30 people and 18 cars to serve the projected new population (Table 3-8). Rangely and Meeker would increase their forces to about 5 people and 4 cars each in 2010. However, with the proposal Rangely would require about 7 people and 4 cars while Meeker would require about 8 people and 4 cars.

In order to continue the level of fire protection in 2010 without the proposed project, Rifle would need about 8 trucks, Rangely, 6 trucks, and Meeker, 4 trucks. With the increased populations associated with the proposal, Rifle would need a total of 10 trucks, Rangely, 7, and Meeker, 6. In addition, the number of volunteer firemen would be required to increase proportionately.

School Capacities

Capacity in Rifle would be exceeded a year earlier, 1983, than would occur with trended population only (Table 3-15). Meeker's capacity would be exceeded in about 1985, which would not occur with trended population only. The number of new classrooms and schools that would be required in these communities is shown in Table 3-16.

Providing the required added capacity would not be instantaneous to need. As a result, short-term crowding would occur and use of temporary facilities with the effect of lessening the teaching and learning experience. New students, from outside the area, would also bring different exposures with them and a pressure for modifying existing curriculums.

Health Care System

Assuming a 60 percent occupancy rate, approximately 40 additional hospital beds would be required in Rifle by about 1995 to serve the total new population at the current service level. In Rangely, about 35 new beds would be required by approximately 1984, and in Meeker, 25 new beds would be required by about 1982.

Public Financing

A comparison of the costs and revenues in the counties, communities, and school districts in the project area are shown in Tables 3-17 through 3-24. Costs are based on providing the projected new population (Table 3-8) with community services at their existing levels. Revenues are monies from

Year	Rifle MGD Needed	Rifle % Capacity	% Capability/Town Rangely MGD Needed	Rangely % Capacity	Meeker MGD Needed	Meeker % Capacity
1980	1.24	26	.82	39	.59	49
1981	1.30	28	.85	40	.62	51
1932	1.41	30	.91	43	.76	63
1983	1.52	32	.96	45	.88	73
1984	1.75	37	1.07	51	1.15	96
1985	2.00	43	1.18	56	1.46	122
1990	2.10	45	1.15	55	1.25	104
1995	2.36	50	1.22	58	1.29	108
2000	2.63	56	1.28	61	1.34	111
2010	3.16	67	1.40	67	1.42	118

Note:

Refer to Table 3-8 for total new population figures.

MGD is defined as millions of gallons per day.

AMOUNT (%) OF WATER TREATMENT CAPACITIES USED BY THE TOTAL NEW POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 3-11

Year	Rifle Sewage Generated	Rifle % Capacity	Rangely Sewage Generated	Rangely % Capacity	Meeker Sewage Generated	Meeker % Capacity
1980	2.65	27	1.98	50	1.99	50
1981	2.77	28	2.03	51	2.08	52
1982	3.01	30	2.16	54	2.53	63
1983	3.23	32	2.29	57	2.94	74
1984	3.73	37	2.54	64	3.84	96
1985	4.21	42	2.82	71	4.87	122
1990	4.47	45	2.75	69	4.17	104
1995	5.03	50	2.89	72	4.32	108
2000	5.60	56	3.04	76	4.46	112
2010	6.44	64	3.14	79	3.97	100

Note:

Sewage generated is in increments of 100,000 gallons per day.

AMOUNT (%) OF SEWAGE TREATMENT CAPACITIES USED BY THE TOTAL NEW POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 3-12

Year	Volume (cubic yards)	Area (acres)
1980	-	-
1981	-	-
1982	477	.10
1983	748	.15
1984	3,583	.74
1985	1,238	.26
1986	200	.04
1987-2006	26,000	5.37
2007-2008	280,640	57.98
Total	312,886	64.64

Note:

Disposal needs are based on Table 1-5.

Assumptions are the same as shown in Table 2-8.

VOLUME OF SOLID WASTE GENERATED BY THE PROPOSED SUPERIOR OIL PROJECT AND AREA REQUIREMENT FOR DISPOSAL

TABLE 3-13

	Rifle		Rangely		Meeker	
Year	Cubic yards generated	Acres required for disposal	Cubic yards generated	Acres required for disposal	Cubic yards generated	Acres required for disposal
1980	4,221	.87	3,166	.65	3,171	.66
1981	4,426	.91	3,237	.67	3,313	.68
1982	4,799	.99	3,454	.71	4,041	.83
1983	5,150	1.06	3,653	.75	4,694	.97
1984	5,959	1.23	4,047	.84	6,138	1.27
1985	6,719	1.39	4,493	.93	7,773	1.61
1990	34,621	7.15	22,208	4.59	36,077	7.45
1995	37,897	7.83	22,536	4.66	33,867	7.00
2000	42,398	8.76	23,701	4.90	35,016	7.23
2010	98,298	20.31	50,904	10.52	73,488	15.18
Total	244,288	50.50	141,399	29.22	207,578	42.88
Present area	-	22.50	-	2.80	-	21.00
Area needed	-	28.00	-	26.42	-	21.88

Note:

Population projections as shown in Table 3-8.

Assumptions are the same as shown in Table 2-8.

SOLID WASTE DISPOSAL AREA NEEDED TO SATISFY THE TOTAL NEW POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 3-14

Year	Rifle		Rangely		Meeker	
	Student Pop.	% Capacity	Student Pop.	% Capacity	Student Pop.	% Capacity
1980	1,480	87	590	49	658	54
1981	1,549	91	603	50	682	56
1982	1,644	96	639	53	794	66
1983	1,734	101	672	56	885	73
1984	1,900	111	735	61	1,104	91
1985	2,058	120	807	67	1,360	112
1990	2,164	127	798	66	1,207	100
1995	2,610	153	841	70	1,255	104
2000	2,928	171	885	74	1,304	108
2010	3,633	212	927	77	1,221	101

Note:

Student population is based on the assumption of maintaining 23 percent of the population as school age.

The areas of the school districts and their existing student capacities, as supplied by the Superintendent of each school district are:

Rifle = Rifle, Silt, Newcastle, and 20 percent of the balance of the county. Student capacity is about 1,710.

Rangely = Rangely and 40 percent of the balance of the county. Student capacity is aobut 1,200.

Meeker = Meeker and 60 percent of the balance of the county. Student capacity is about 1,210.

AMOUNT (%) OF SCHOOL CAPACITIES USED BY THE PROJECTED NEW POPULATIONS IN RIFLE, RANGELY, AND MEEKER

TABLE 3-15

Year	Rifle			Meeker		
	Number Of Students Over Capacity	Classrooms Required	Schools Required	Number Of Students Over Capacity	Classrooms Required	Schools Required
1983	24	1	-	-	-	-
1984	190	8	-	-	-	-
1985	348	14	1	150	6	-
1990	454	18	1	-	-	-
1995	900	36	2	45	2	-
2000	1,218	49	3	94	4	-
2010	1,923	77	5	11	-	-

PROJECTED CLASSROOMS AND SCHOOLS REQUIRED IN RIFLE AND MEEKER TO ACCOMMODATE THE PROJECTED NEW POPULATIONS

TABLE 3-16

Year	Costs ($) Capital	O & M	Total	Property	Revenues ($) Other	Total
1980	3,077	323	2,210	888	1,938	2,826
1981	7,964	836	5,720	2,299	5,016	7,315
1982	41,992	4,408	30,160	12,122	26,448	38,570
1983	72,400	7,600	52,000	20,900	45,600	66,500
1984	175,027	18,373	125,710	50,526	110,238	160,764
1985	273,853	28,747	196,690	54,549	173,482	228,031
1990-2010	213,402	22,401	235,803	54,549	119,016	173,565

COSTS AND REVENUE ANALYSIS FOR GARFIELD COUNTY WITH THE PROPOSED SUPERIOR OIL PROJECT (CONSTANT 1977 DOLLARS)

TABLE 3-17

Year	Costs ($) Capital	O $ M	Total	Property	Revenues ($) Other	Total
1980	9,412	988	6,760	18,876	5,928	24,804
1981	23,349	2,451	16,770	26,813	14,706	41,519
1982	125,071	13,129	89,830	79,282	78,774	158,056
1983	215,209	22,591	154,570	119,894	135,546	255,440
1984	422,816	44,384	303,680	142,053	266,304	408,357
1985	658,840	69,160	473,200	182,538	414,960	597,498
1990-2010	459,197	48,203	507,400	586,712	289,218	875,930

COSTS AND REVENUE ANALYSIS FOR RIO BLANCO COUNTY WITH THE PROPOSED SUPERIOR OIL PROJECT (CONSTANT 1977 DOLLARS)

TABLE 3-18

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	3,128	340	2,254	612	443	816	1,871
1981	7,299	795	5,261	1,429	1,133	1,904	4,466
1982	38,844	4,231	27,998	7,603	5,937	10,132	23,672
1983	66,739	7,270	48,105	13,062	10,012	17,408	40,482
1984	169,500	18,460	122,174	33,166	22,991	44,200	100,357
1985	264,000	28,769	190,299	36,024	36,040	68,884	140,948
1990-2010	184,000	20,050	240,050	36,024	22,940	48,008	106,972

COSTS AND REVENUE ANALYSIS FOR RIFLE
WITH THE PROPOSED SUPERIOR OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-19

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	2,600	280	1,872	975	155	950	2,080
1981	6,240	672	4,492	2,342	437	2,280	5,059
1982	34,060	3,668	24,523	12,782	2,336	12,445	27,563
1983	59,020	6,356	42,494	22,150	3,916	21,565	47,631
1984	115,700	12,460	83,304	43,421	7,399	42,275	93,095
1985	180,440	19,432	129,916	47,226	11,578	65,930	124,734
1990-2010	125,840	13,552	139,392	47,226	7,205	45,980	100,411

COSTS AND REVENUE ANALYSIS FOR RANGELY
WITH THE PROPOSED SUPERIOR OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-20

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	10,400	1,120	7,488	1,964	783	3,280	6,027
1981	26,000	2,800	18,720	4,910	1,976	8,200	15,086
1982	137,020	14,756	98,654	25,876	10,606	43,214	79,696
1983	235,820	25,396	169,790	44,534	17,926	74,374	136,834
1984	463,580	49,924	333,777	87,545	33,810	146,206	267,561
1985	722,280	77,784	520,041	95,058	53,214	227,796	376,068
1990-2010	503,360	54,208	557,568	95,058	33,135	158,752	286,945

COSTS AND REVENUE ANALYSIS FOR MEEKER
WITH THE PROPOSED SUPERIOR OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-21

Year	Capital	Costs ($) O & M	Total	Revenues ($) Property	Total
1980	-	4,272	4,272	2,245	2,245
1981	-	10,146	10,146	5,332	5,332
1982	-	53,667	53,667	28,205	28,205
1983	-	92,649	92,649	48,693	48,693
1984	-	232,290	232,290	122,083	122,083
1985	-	361,785	361,785	190,140	190,140
1990-2010	-	252,048	252,048	132,467	132,467

COSTS AND REVENUE ANALYSIS FOR THE RIFLE SCHOOL DISTRICT (RE-2)
WITH THE PROPOSED SUPERIOR OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-22

Year	Capital	Costs ($) O & M	Total	Revenues ($) Property	Total
1980	-	2,760	2,760	189	189
1981	-	6,900	6,900	473	473
1982	-	37,812	37,812	2,589	2,589
1983	-	65,688	65,688	4,498	4,498
1984	-	128,892	128,892	8,826	8,826
1985	-	200,928	200,928	13,759	13,759
1990-2010	-	139,932	139,932	9,582	9,582

COSTS AND REVENUE ANALYSIS FOR THE RANGELY SCHOOL DISTRICT (RE-4)
WITH THE PROPOSED SUPERIOR OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-23

Year	Capital	Costs ($) O & M	Total	Revenues ($) Property	Total
1980	-	11,592	11,592	4,539	4,539
1981	-	28,980	28,980	63,224	63,224
1982	95,000	152,628	247,628	448,835	448,835
1983	95,000	261,924	356,924	745,825	745,825
1984	95,000	348,864	443,864	823,964	823,964
1985	95,000	803,712	898,712	1,287,389	1,287,389
1990	95,000	560,280	655,280	4,394,952	4,394,952
1995	95,000	560,280	655,280	4,202,920	4,202,920
2000-2010	95,000	560,280	655,280	4,183,324	4,183,324

COSTS AND REVENUE ANALYSIS FOR THE MEEKER SCHOOL DISTRICT (RE-1)
WITH THE PROPOSED SUPER OIL PROJECT
(CONSTANT 1977 DOLLARS)

TABLE 3-24

taxes and other means that the governmental entities would collect from the new population and other sources, including taxes levied on the proposed Superior project.

The community service elements described above are the more significant ones in terms of public necessities and costs. Inherent in the analysis are all forms of community services including social services and parks.

The primary sources for background information were analyses of the historical and current budgetary data of each of the governments. All figures are in constant 1977 dollars and are assumed to remain constant throughout the time frame of the proposed project.

COST

The costs associated with providing the new population with community services are divided into capital and operation and maintenance (O&M) as shown in the tables. Capital costs are those associated with additions to, or improvements of, facilities including equipment, buildings, and parks. O&M is the increased and new operation and maintenance that would be necessary because of new facilities and increased use of existing facilities. In the columns titled "Total," the 1980-85 period has been adjusted for the impermanency of the population during project construction.

An average $181 per capita factor was applied to the new population in Garfield and Rio Blanco Counties to derive capital costs, while $19 per capita was applied for O&M (Tables 3-17 and 3-18). For the three communities, a $260 factor was used for capital cost and $28 for O&M (Tables 3-19, 3-20, and 3-21).

Capital improvement requirements for the three school districts were analyzed separately. In the "capital" columns of Tables 3-22, 3-23, and 3-24, where there are blanks, it has been assumed that other arrangements would be made for facilities instead of new building construction. Based on a per student O&M rate of $1,200, a per capita cost factor of $276 was used.

REVENUE

Property tax revenue from individuals was projected for each of the three major governmental entities. The basis for the projections was a historically derived multiplier of per capita property valuation, at a rate of 2.5, times the applicable mill levies. The product of this multiplication was then multiplied by the change in, or additional, population that would occur within the boundaries of the governmental entities.

Corporate property tax revenues from Superior were projected on the basis of an annual capitalized value of the facilities. The value was reduced by the statutory allowance of 10 percent per year to a maximum 40 percent, multiplied by a 30 percent assessed valuation rate, and then multiplied by the applicable mill levies. Added to the property tax revenue from construction of the project was a nonproducing mineral reserve tax that would be collected at a rate of $2.79 per acre, until production, and a mineral extraction tax collected during production. The mineral extraction tax would be at a rate of 25 percent gross income from extraction times the applicable mill levies, or net revenue from extraction times the levies. Revenues from the corporate property tax would be collected in only Rio Blanco County and the Meeker School District within whose jurisdictions the facility would be located.

Sales tax within the communities were projected based on the gross wages that would be paid times the reduction factor due to net disposable income, leakage of income from the study area, and nonexposure of certain expenditures to sales tax liability. Factors used were 0.7 times gross income for the net disposable income, 0.55 times net for leakage, and 0.6 times net income for nonexposed expenditures. Leakage is money, or income, not spent in the community but spent elsewhere, such as in Grand Junction and Denver as is the present situation in the project area.

Gross income was determined from the analysis of average gross incomes of Superior and non-basic employees. The net income spent on taxable items in the study area was multiplied by the tax factor equal to the sales tax rate plus the use tax factor, which is 10 percent of the sales tax rate.

"Other" revenue was projected by applying a per capita factor to the projected change in population. The factor was derived from an analysis of revenues including fines, penalties, licenses, fees, grants, and excise taxes. Oil shale trust funds that could be transferred into the area by the state are not accounted for. This fund is paid to the state through provisions in the prototype oil shale leasing program and are used to defray costs resulting from oil shale development. The interrelated Ca and Cb projects, described in Chapter 6, are a part of this prototype program.

Ultimate Effects

The analysis is based on the ability of the different governmental entities to "afford", or publicly finance, continued current levels of community services with the new population. With sufficient revenues, the level of service would remain static or increase. Without sufficient revenues either the level of service would decrease or the people would increase their taxes to cover costs.

In Garfield County, revenues would exceed costs through about 1985. From that time on, costs

would exceed revenues. The impact would be an initial expansion of services (80 percent probability) followed by a decreasing of service or increased taxation (50 percent probabilities). Rationale behind the low probabilities is that the project area encompasses a relatively small portion of the total county in terms of area, population, and economic activity. Therefore, the deficit, when distributed throughout the county, can be more readily absorbed.

Throughout the time frame of the proposed Superior project, revenues would exceed costs in Rio Blanco County. All services would expand (90 percent probability). Not all the monies would be spent on expanded services however. Due to increased traffic as a result of the project, maintenance costs, primarily on Piceance Creek Road, would be higher, and would be paid out of this revenue.

Except for approximately the first four years in Rangely, costs would be greater than revenues in the three communities in the project area. The levels of service would decrease or taxes would be increased (50 percent probabilities). The probabilities are based on the fact that the populations of the communities in Rio Blanco County constitute the vast majority of the total populations of the county. And, with surplus county revenues available, the people would most likely redistribute the money, as much as is legally possible, to accommodate their total needs. The mitigating circumstances in Garfield County are discussed above.

With either a deficit financial condition and lowered levels of service, or increased taxation, people would be encouraged to develop outside the jurisdictions of the towns (60 percent probability) or to live in larger towns in the region, such as Grand Junction and Craig, and commute to work (80 percent probability). Pressures on services within those areas would increase as would the "leakage" of incomes from the project area communities thereby further degrading their economic viabilities.

The Meeker school district would take in more revenues than projected costs, primarily because the project facilities would be located within the taxing jurisdiction of that district. The potential for students receiving higher quality educations would be available (90 percent probability). An expansion of facilities and curriculum would occur. There would be more, and better paid, teachers and other personnel.

Rifle and Rangley school districts would not receive sufficient revenues to offset projected costs. Characteristically, the quality of education would be lowered (75 percent probability). Facilities would be crowded, teacher to student ratios reduced, and other disruptions would occur that distract from the education process.

Lifestyle

Affecting the small town and rural lifestyles of the people in the project area would be the new employment and income opportunities and the new people that would migrate in to take advantage of these opportunities. Also, the perceived physical environment would be altered by the proposed project and the requirements of the new population.

People with new tastes, preferences, and attitudes would migrate into the area, thereby affecting social structure and self-identity of the area. There would be increased requirements for housing, community services, and urban-type amenities.

The physical environment would be affected by the project in terms of decreased air quality and increased traffic and noise. New demands would be placed on the area by the new population for uses including building sites, recreational, and other open space-type uses.

Ultimate Effects

The trend from an agricultural-type lifestyle towards an industrial-type lifestyle would be accelerated with the proposed project. The more relaxed and casual way-of-life would change to a more suburban style (90 percent probability). The causes of the change would include increased business activity and an increase in the number of people living in the area. The new style would detract from the friendliness and solidarity the people currently have, as would the arrival of more people with speculative ethics.

Existing economic and living patterns would be changed (85 percent probability). Social factions and possible isolation of groups, would occur between the "newcomers" and those currently living in the area (30 percent probability). The new people would receive higher wages than most and would be bound to one another as a result of their common employments.

With increased employment opportunities, the scarcity of jobs and the low income situation would be alleviated. Locals, primarily youths, would not need to leave the area to find employment. Relatively lower-paid employees in the area would have the opportunity to move up.

Opportunity for urban-type amenities such as shopping facilities and urban recreation opportunities would increase (95 percent probability). This aspect is generally desired by the existing population and would increase the quality of life.

The requirements of the new population for housing, community services, and urban-type amenities would impact the people of the area. Overall, the cost of living would go higher (90 percent probability), impacting mostly those on

fixed incomes. An example being competition for housing which would further aggravate an already high-market price of housing.

Within the governmental boundaries in which the cost of providing community services exceeds revenue, either the service levels would drop or taxes would be increased. Again, those people who would feel the increase in taxes the most would be those on fixed incomes. Decreased services would affect everyone by lowering the quality of life. Where revenues exceed cost, the quality of service would increase.

Valued elements of the physical environment that would be impacted include "clean air", quietness, appearances of the towns, and remoteness (90 percent probabilities). The impact would be on the mental well-being of the population.

Air quality would be decreased in and around the site of the proposed project. Noise levels would increase at the site, along the highways, and within the towns, as a result of increased traffic and activity.

The pattern of growth within the communities would be suburban. The physical appearance of the new areas would be neither western nor small town as desired by the people currently living in those towns.

Open space would be taken up in the towns by new buildings. Remoteness would also diminish because of the greater number of people in the area and increased traffic and noise.

LAND USE

With the proposed land exchange, the public land ownership would be consolidated. The land BLM would receive would be divided and reallocated to the adjoining ranchers who are presently permitted to graze livestock. Five ranches would be affected. Two would lose about 20 animal unit months (AUMs) and another would have no net loss. These three ranches, when compared to the total size of the operations, would not be significantly affected. However, the remaining two ranches would lose significant AUMs, about 190 AUMs each--20 as a direct loss of forage and 170 by having the livestock cut off from water in Piceance Creek.

Recreation experiences, or quality, in the area and especially at the DOW's Rio Blanco Lake State Fishing Area would be reduced. Noise from the traffic and the proposed plant and the reduced visibility from decreased air quality would detract from the quality of the area, as would the increase in the number of people recreating in the area. This reduced experience would not significantly affect the usage of the Fishing Area which is now about 10,000 people-hours.

Ultimate Effects

Consolidation of public lands would facilitate better surface and mineral management by BLM (90 percent probability). This would come about by creating a contiguous ownership pattern which is not now the case (Map 1-2). A more logical mining unit would be possible should future leasing occur. The definition of a logical mining unit is an area that can be developed and mined in an efficient, economical, and orderly manner while conserving the natural resources.

The two ranches that would be significantly affected by the proposed land exchange have been modeled to estimate economic impacts. Changes in gross and net revenues would occur as a result of the change in forage use and subsequent change in herd size. Changes in revenue were evaluated, based on budget information obtained from surveys of ranches in northwest Colorado by Colorado State University (CSU). The survey was part of a study being funded jointly by BLM, U.S. Forest Service, and the state on which a final report is currently being prepared.

The two ranches were not specifically analyzed since the data is not available. It was assumed that the ranches, which are essentially identical, would fall within an average herd size category for the area. For this category there are average gross and net revenues available from the CSU study, along with other budget information. With a loss of about 190 AUMs, gross revenues would drop from about $53,300 annually to $47,700. On the average, ranches within this size category have negative net revenues and it is assumed that outside incomes subsidize the operations. Net revenues would drop from a minus $3,560 to approximately minus $5,700.

The range of impacts would be forcing the rancher out of business (20 percent probability) or continuing the operation with increased outside subsidies (80 percent probability). The reason for the higher probability is that, with the project, more high-paid jobs would be available in the area.

HIGHWAY SYSTEM

The increase in demand on the road system in the project area is calculated in terms of peak-hour traffic which is further divided into average peak-hour (APH) and maximum peak-hour (MPH) (Figure 3-25). APH is the highest traffic hour expected on any given day of the week, while MPH is the thirtieth highest traffic hour of the year, which corresponds to a definition used by the State Highway Department.

In analyzing the effects on the road systems, it was assumed that no carpooling or other mass transit to and from the project site would take place,

		AVERAGE PEAK HOUR					MAXIMUM PEAK			
Year	Road Seg.	APH	SPH	TPH	CAP	TPH as Coeff. of CAP	MPH	SPH	TMP	TMP as Coeff. of CAP
1980	A	100	0	100	1,100	.09	160	0	160	.15
	B_1	30	0	30	500	.06	40	0	40	.08
	B_2	30	0	30	500	.06	40	0	40	.08
	C	110	0	110	1,100	.10	220	0	220	.20
	D	70	0	70	1,100	.06	140	0	140	.13
	E	50	0	50	820	.06	100	0	100	.12
	F	80	0	80	820	.10	140	0	140	.17
1985	A	120	73	193	1,100	.18	240	73	313	.28
	B_1	40	72	112	500	.22	60	72	132	.26
	B_2	30	72	102	500	.20	50	72	122	.24
	C	120	73	193	1,100	.18	240	73	313	.28
	D	80	7	87	1,100	.08	150	7	157	.14
	E	60	458	518	820	.63	100	458	558	.68
	F	80	126	206	820	.25	150	126	276	.34
1990	A	130	61	191	1,100	.17	190	61	351	.23
	B_1	40	30	70	500	.14	60	30	90	.18
	B_2	40	30	70	500	.14	60	30	90	.18
	C	130	31	161	1,100	.15	260	37	291	.26
	D	80	7	87	1,100	.08	160	7	167	.15
	E	60	169	229	820	.28	110	169	279	.34
	F	90	53	143	820	.17	150	53	203	.25
1995	A	140	61	201	1,100	.18	210	61	271	.25
	B_1	50	30	80	500	.16	70	30	100	.20
	B_2	40	30	70	500	.14	60	30	90	.18
	C	140	31	176	1,100	.16	280	31	311	.29
	D	80	7	87	1,100	.08	160	7	187	.15
	E	60	169	229	820	.28	110	169	279	.34
	F	90	53	143	820	.12	160	53	213	.18
2000	A	150	61	211	1,100	.19	220	61	281	.35
	B_1	50	30	80	500	.16	70	30	100	.20
	B_2	50	30	80	500	.16	80	30	110	.22
	C	150	31	186	1,100	.17	300	31	331	.31
	D	90	7	97	1,100	.09	180	7	187	.17
	E	60	169	229	820	.28	120	169	289	.35
	F	90	53	143	820	.17	170	53	223	.27
2005	A	160	61	211	1,100	.20	240	61	301	.27
	B_1	50	30	80	500	.16	80	30	110	.22
	B_2	50	30	80	500	.16	80	30	110	.22
	C	160	31	191	1,100	.17	320	31	351	.32
	D	90	7	97	1,100	.09	180	7	187	.17
	E	70	169	237	820	.29	120	169	289	.35
	F	100	53	153	820	.19	180	53	233	.28
2007	A	170	11	181	1,100	.16	250	11	261	.24
	B_1	50	6	56	500	.11	80	6	86	.17
	B_2	60	6	66	500	.13	90	6	96	.19
	C	170	5	175	1,100	.16	340	5	345	.32
	D	100	----	100	1,100	.09	190	0	190	.17
	E	70	41	111	820	.14	120	41	161	.23
	F	100	8	108	820	.13	180	8	188	.23

NOTE: APH = Average Peak Hour Traffic
SPH = Superior's Peak Hour Traffic
TPH = Total Peak Hour Traffic-APH + SPH
CAP = Capacity-Volume at Service Level "C"
MPH = Maximum Peak Hour Traffic
TMP = Total Maximum Peak Hour Traffic-SPH + MPH

PEAK HOUR TRAFFIC VOLUME TO CAPACITY
FOR ROAD SEGMENTS IN THE PROJECT AREA
WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-25

non-work trips would not occur during the hour of peak traffic, and the largest project work shift change would occur during the peak traffic hour.

APH and MPH were calculated by adding together by road segment the peak hour volumes from Table 2-11, average hourly project truck loads, and project employee trips. The total loads (Figure 1-4) were divided by 24-hours to get the average hourly project truck loads. Project employee trips were calculated by distributing the maximum work shift of about 230 people over the different road segments according to the population distribution shown in Table 3-8.

The sum of the traffic by road segments, and by year, was divided by the capacity of the segments (Figure 2-11) to arrive at a coefficient of volume capacity. Any coefficient more than one, of which there are none, indicates a decrease in service level.

Ultimate Effects

The impact from the project truck haulage and increased population would be higher highway maintenance costs to the state and Rio Blanco County (95 percent probability). Trucks loaded to capacity and running constantly, as would occur with the project, would be the primary factor in increased maintenance; however, there is no data available to quantify such an increase.

Congestion would occur especially during the time school buses are in operation (95 percent probability). In addition to driver frustration, safety hazards would increase with corresponding loss of lives and property. The expected result of those hazards are quantified in Chapter 6, Health and Safety.

Increased traffic affects the land use and noise components of the environment. The Public Finance subcomponent of Socioeconomics would also be affected.

NOISE

During construction of the proposed project, traffic volume would vary. However, during operation a truck would leave the plant area every 2 minutes. A truck would pass through Rifle every 5 minutes and through Rangely and Meeker every 6 and 9 minutes, respectively.

Noise levels by road segments in the project area are shown in Table 3-26. Locations of the road segments are shown in Figure 1-24. Methods used in calculating noise levels were identical to the discussion in Chapter 2, Noise, and were applied to the project related traffic (Table 3-25). In the calculations, road roughness was not taken into account.

At the project site, machinery noise, in addition to traffic noise, was taken into account. The projected machinery noise level is discussed in Chapter 1, Project Summary. Generally, the increase would be about 3 decibels (dba) in equivalent continuous sound (L_{eq}). The dba would remain within the approximate range of 60 to 70. Sixty dba corresponds to face-to-face conversation while 70 dba is urban street noise. The projected levels would be 87 dba at 50 feet once every five to ten minutes depending on traffic frequency.

At the plant site, the 90 dba emission from the machinery would diminish to approximately 70 dba along Piceance Creek Road. The decibel level at Rio Blanco Lake (Map 1-2) would be between 45 and 50.

Ultimate Effects

The population along the highways and in Rangely, Meeker, and Rifle would be affected. Impacts would be: physiological, such as startling reactions; behavioral interference with activities such as speech, sleep, and work; and, subjective effects such as annoyance (85 percent probability) (*U.S. Department of Commerce [2], 1977, and U.S. Air Force, 1976*).

Other impacts would be potential lowering of property values (40 percent probability) and altering of wildlife habitats (20 percent probability). The increased noise would affect the Land Use component and the Lifestyles sub-component of Socioeconomics.

VISUAL RESOURCES

During the approximately 20 years that the project features would be in existence, they would dominate the landscape and not be visually acceptable in accordance with the BLM's visual resource management (VRM) Class II and III standards for the site, which are defined in the Visual Resource section of Chapter 2. Also, the relative scenic nature of the area surrounding the project site would be degraded by reduced visibility as a result of decreased air quality.

Visual effects of the proposed project were compared to existing characteristics of the area and assigned a numerical contrast rating in accordance with BLM Manual 8400. The result of the rating was that the proposed features would not meet allowable limits for the existing VRM Class II, III, or IV, which are defined in Chapter 2, Visual Resources. The effect would be a change in the perception of the area thereby affecting the Lifestyles subcomponent of Socioeconomics.

CULTURAL RESOURCES

There are eight sites located on public land that appear to be eligible for the National Register of

a. Decibel (dba) at 50 Feet

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	65.5	67.0	66.7	67.0	67.2	67.3	66.8
B_1	52.6	60.4	59.4	60.4	60.4	60.4	55.9
B_2	51.2	60.4	59.4	59.4	60.4	60.4	56.5
C	63.9	65.6	66.2	66.5	66.7	66.7	66.9
D	64.9	66.0	66.2	66.4	66.5	66.5	65.8
E	63.3	67.0	67.3	67.3	67.5	67.5	65.8
F	64.2	65.6	66.7	66.9	67.0	67.0	65.6

b. Distance in Feet to the 50 dba Contour

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	300	350	340	350	360	370	345
B_1	65	170	150	165	165	165	100
B_2	60	170	150	150	165	165	105
C	250	300	325	300	340	340	350
D	275	320	325	300	335	335	315
E	230	350	360	360	375	375	315
F	255	300	340	350	350	350	310

NOISE LEVELS IN THE PROJECT AREA WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-26

	Class II PSD Incremental Standards		Ambient Air Quality Standards			Exist. Level at the Site	Superior Increment	New Ambient Concentration
	Federal	State	Federal (Primary)	Federal (Secondary)	State			
Total Suspended Particulates								
Annual	19	-	75	60	75	11	28	39
24-Hour	37	-	260	150	260	11	96	107
Sulfur Oxides								
Annual	20	10	80	-	-	10	1	11
24-Hour	91	50	365	-	-	133	10	90
3-Hour	512	300	-	1,300	700	218	-	-
Nitrogen Oxides								
Annual	-	-	100	100	100	10	12	22
Non-Methane Hydrocarbons								
3-Hour (6-9 a.m.)	-	-	160	160	-	220	15	235
Oxidant (Ozone)								
1-Hour	-	-	235	235	235	180	-	-
Carbon Monoxide								
8-Hour	-	-	10,000	10,000	10,000	4,400	25	4,425
1-Hour	-	-	40,000	40,000	40,000	5,300	75	5,375
Total Suspended Particulates								
Annual	19	-	75	60	75	11	8	19
24-Hour	37	-	260	150	260	11	30	41

AIR QUALITY STANDARDS AND MAXIMUM PREDICTED AIR POLLUTION CONCENTRATIONS WITH THE PROPOSED SUPER OIL PROJECT ($\mu g/m^3$)

TABLE 3-27

Historic Places. With the proposed land exchange, these eight sites would lose the protection afforded by state and federal law. Four of the eight sites would be physically disturbed by construction of the proposed project.

Ultimate Effects

With the loss of public ownership, and disturbance, the information that the sites potentially contain would not be recovered (95 percent probability). The sites are likely to yield scientific information important in prehistory.

Increased population and human activity in the area would result in a reduction of the integrity of cultural resources through vandalism and off-road vehicle use (60 percent probability).

CLIMATE AND AIR QUALITY

Emissions from the proposed project and baseline meteorological data (*CDM, 1978*) were used in models to estimate effects on air quality. Project emission rates used in the modeling were higher than those shown in Tables 1-6 and 1-7. The result was a maximization of the potential effect of the project. Specific information about the modeling procedures, including the meteorological data, is available upon request to the BLM.

Total suspended particulate (TSP) concentrations during construction were calculated using the ERTAQ model, which is described in Roberts (1977). ERTAQ was also used to calculate nitrogen oxides (NO_x), non-methane hydrocarbons (NMHC), and carbon monoxide (CO) concentrations during the operational component of the project. The results of these calculations are shown in Table 3-27, which also shows TSP and sulfur dioxide (SO_2) during operation. The Valley Model, as described in U.S. Environmental Protection Agency (1977), was used for TSP and SO_2. Use of the Valley Model is reported in CDM (1978) and estimates that the maximum off-site concentration would occur about .75 mile north of the proposed plant site.

The effect of increased TSP during construction would be to reduce visibility from about 75 miles to about 47 miles in an area of about a mile around the plant site. Beyond that distance the loss of visibility would be nominal. Methods contained in Charlson (1969) were used to calculate this reduction.

During project operation, excess nitrogen dioxide (NO_2) would be present after complete chemical reduction of non-methane hydrocarbons in the immediate project area. Through chemical reactions, this NO_2 would reduce existing oxidant levels near the plant site and would generate increased oxidant levels farther downwind. The net change in oxidant levels in and around the study area would be less than 10 percent of existing 180 $\mu g/m^3$ levels. The combined effect of the increase in TSP and nitrogen oxides would reduce visibility from about 75 miles to about 54 miles, which would affect visual resources within a radius of about a mile around the proposed plant.

From the cooling tower discharge, salt deposition rates of about 250 lbs/acre/year would occur in an elliptical-shaped area about 3,000 feet long running roughly north-northeast to south-southwest situated just to the north of the cooling tower. The total area affected would be about 80 acres. Water quality would be affected.

There are two areas designated as Class I within the region. Dinosaur National Monument, located about 30 miles northwest of the proposed project site, has been designated by Colorado. Flat Tops Wilderness Area, about 35 miles to the east, has federal designation. In these two Class I areas, the proposed project would not cause PSD increments to be exceeded.

Ultimate Effects

Throughout the life of the project, new ambient concentrations, as shown in Table 3-27, do not exceed National Ambient Air Quality Standards except for non-methane hydrocarbons which are presently exceeded (Table 2-13). And, except for TSP during construction, 1982 through 1986 (Figure 1-2), the new concentrations do not exceed the Class II Prevention of Significant Deterioration (PSD) increments. The TSP increment during construction, which is shown as 96 micrograms per cubic meter, would exceed the allowable Class II increment of 37 (10 percent probability). The reason for the low probability is that the maximized emission rate modeled included the emissions from the initial year of construction, 1982, plus initial nahcolite production that is scheduled for 1984 (Table 1-6). In 1982, the TSP emission level would be at its highest compared to subsequent construction years, including 1984.

GEOLOGY AND MINERALS

Approximately 237 million tons of coal with a 3 percent sulfur content would be used as fuel in electrical generating plants with the total project production of over 40 million tons of nahcolite (Table 1-1). This coal can presently be burned but the use of nahcolite to remove the sulfur dioxide from the flue gas makes the use more economical compared to other methods. Using nahcolite at a rate of .17 ton per ton of coal, approximately 85 percent of the sulfur would be removed.

U.S. consumption of oil is about 600 million barrels annually, or about 16 million barrels per day.

Superior's proposed production of about 84.5 million barrels in a 20-year time period would amount to about a 5-day supply.

One ton of alumina will produce about .5 ton of aluminum. The over 4 million tons of alumina that Superior would produce would be further refined and produce about 2 million tons of aluminum or about a 4-month supply based on a U.S. consumption rate of about 5.5 million tons per year.

Approximately 200 million tons of soda compounds are used in the U.S. each year. The proposed production of over 7 million tons of soda ash is approximately a 2-week supply.

Ultimate Effects

Assuming an overall recovery rate of 55 percent, appproximately 19 million tons of nahcolite, 59 million barrels of shale oil, 0.5 million tons of alumina, and 3 million tons of soda ash would not be recovered using current technology (90 percent probability).

Production of the proposed quantities of minerals (Table 1-1) by Superior is insignificant in terms of the total requirements of the U.S. The magnitude of a project and the investment needed to develop oil shale so that U.S. requirements could be met is too great for one private development. However, successful operation of the proposed project would add new technology and lead to further incremental recovery of the mineral resources in Piceance Basin (75 percent probability), which has the potential to be significant in terms of meeting the country's needs.

WATER RESOURCES

Water Quantity

Effects that the proposed Superior project would have on the annual discharge of Piceance Creek and the White River are shown in Table 3-28. The flow in Piceance Creek would be affected by removal of process water from the lower aquifer and other project uses, increased runoff from the plant site, change in irrigation patterns, and the cut-off of alluvial flow.

Removal of process water from lower aquifer, which would be about 3.3 million gallons daily or 3,700 acre-feet yearly, would decrease the discharge of the groundwater aquifer system into the alluvial aquifer and ultimately the flow in Piceance Creek. There are no site-specific data nor site-specific simulation models. Therefore, the results of hydrologic data and the simulation model described in USGS (1974) were used, assuming all the decreased discharge was reduced stream flow. Within the first two years after project water usage stops, the flow in Piceance Creek would return to within about 75 percent of normal and reach full equilibrium within approximately 20 years.

Other project uses that would be made of water from Piceance Creek are irrigation and dust control during construction. For stabilization, the soil stockpiles would be irrigated. Roads and other areas disturbed by earth moving would be wetted to help control dust.

Increased water runoff from storms would occur as a result of grading, paving, compaction, and other alterings of the natural surface. The average increases shown in Table 3-28 assume that the entire 380 acres of disturbance would occur during 1982. After construction, about 10 acres of paved or built-up area would not be included in the project's storm sewage system. Additional runoff was calculated using the methods contained in U.S. Soil Conservation Service (1955). Total monthly changes in runoff were calculated using the computer model described in U.S. Soil Conservation Service (1972).

The historic annual consumption of approximately 275 acre-feet of water by Superior in its irrigation would be reduced once construction of the plant begins. Seventy-five percent, or about 190 acre-feet, would remain in Piceance Creek, the other 85 acre-feet would remain in the White River.

The approximately 300 gallons per minute, or about 480 acre-feet per year, of water flowing through the alluvial aquifer would be stopped once the dike (Figure 1-2) is constructed and would continue until abandonment. This water would drain into the process storage water basin during this time.

In addition to the effects of the decrease of the flow in Piceance Creek, the White River would be affected by plant usages and consumption of potable water by the new increased population in Meeker and Rangely. During the first five years of the project and the last two years, water would be pumped from the White River and treated for potable water usage. Also during these same times, irrigation water would be pumped, blended with water from Piceance Creek, and used for irrigation. Beginning in the fourth year and continuing throughout the operation of the project, the fire control system, or fire loop, would be tested daily by pumping about 9,000 gallons of water from the river.

The populations of Meeker and Rangely, with the project (Table 3-8), would consume about 43 gallons per person daily. This assumes that only 25 percent of the water used is actually consumed.

The overall average annual change in the flow of the White River, as would be measured below Rangely, would be a reduction of about 600 acre-feet. The 600 acre-feet represents about 0.1 percent

Year	Process Water (-)	Irrigation & Dust Control (-)	Increased Runoff (+)	Alluvial Flow Cutoff (-)	Irrigation Cease (+)	Net Change	Plant (-)	New Population Consummation (-)	Irrigation Cease (+)	Net Change
1982	--	7.4	82	0	197	+271.6	17.0	31.7	85	+307.9
1983	--	9.5	59	20.1	197	+226.4	27.0	54.6	85	+229.8
1984	--	--	72	40.2	197	+228.8	25.8	107.4	85	+180.6
1985	--	0.6	72	40.2	197	+228.2	31.3	167.3	85	+120.1
1986	--	0.9	73	40.2	197	+228.9	36.5	157.2	85	+120.2
1987	130.2	--	65	40.2	197	+91.6	10.1	147.0	85	+19.5
1988	296.7	--	65	40.2	197	-74.9	10.1	136.9	85	-136.9
1989	384.8	--	65	40.2	197	-163.0	10.1	126.7	85	-214.8
1990	441.4	--	65	40.2	197	-219.6	10.1	116.6	85	-261.3
1991	504.3	--	65	40.2	197	-282.5	10.1	116.6	85	-324.2
1992	550.2	--	65	40.2	197	-328.4	10.1	116.6	85	-370.1
1993	582.8	--	65	40.2	197	-361.0	10.1	116.6	85	-402.7
1994	608.7	--	65	40.2	197	-386.9	10.1	116.6	85	-428.6
1995	630.9	--	65	40.2	197	-409.1	10.1	116.6	85	-450.8
1996	656.8	--	65	40.2	197	-435.0	10.1	116.6	85	-476.7
1997	682.7	--	65	40.2	197	-460.9	10.1	116.6	85	-502.6
1998	708.7	--	65	40.2	197	-486.9	10.1	116.6	85	-528.6
1999	734.5	--	65	40.2	197	-512.7	10.1	116.6	85	-554.4
2000	760.4	--	65	40.2	197	-538.6	10.1	116.6	85	-580.3
2001	786.3	--	65	40.2	197	-564.5	10.1	116.6	85	-606.2
2002	812.2	--	65	40.2	197	-590.4	10.1	116.6	85	-632.1
2003	836.2	--	65	40.2	197	-614.4	10.1	116.6	85	-656.1
2004	858.4	--	65	40.2	197	-636.6	10.1	116.6	85	-678.3
2005	878.8	--	65	40.2	197	-657.0	10.1	116.6	85	-698.7
2006	899.1	--	65	40.2	197	-677.3	10.1	116.6	85	-719.0
2007	450.0	--	31	0	197	-296.5	20.8	116.6	85	-348.9
2008	225.0	--	0.5	0	197	-58.2	9.7	116.6	85	-99.5

NOTE: Net change in White River Volume is as would occur below Rangely and includes net change in Piceance Creek.

EFFECTS ON THE ANNUAL DISCHARGE OF PICEANCE CREEK AND THE WHITE RIVER WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 3-28

of the average annual discharge. Based on the recorded minimum flow of 250 cfs in the White River, the percentage of reduction of about 1 cfs caused by the project would be 0.4 percent. Piceance Creek, with a recorded minimum flow of 0.5 cfs, would be dry. However, this no flow condition is not expected to occur since Superior was diverting and irrigating at the time the low flow was measured, which would not occur with the proposed project.

Water Quality

The primary outcrop of the lower aquifer, which flows into Piceance Creek, is located about 2 miles south of the proposed portal in an area designated as alkali flats and shown in Map 1-2. The water has a TDS concentration of over 26,000 mg/l. With reduced discharge and inflow in Piceance Creek because of removal of process water from the lower aquifer and the interception of the alluvial aquifer flow by the proposed dike, about 24,500 tons of salt annually would not reach Piceance Creek and, ultimately, the White River. This amounts to a decrease in the 2,270 milligrams per liter (mg/l) TDS concentration in Piceance Creek of about 1,044 mg/l, or 46 percent, and a decrease in the 635 mg/l concentration in White River of about 40 mg/l, or 6 percent.

Other water quality effects that would be caused by the project are suspended sediment increase from erosion, salt loading from dewatering the alluvium, and salt from the proposed cooling tower. During the first year of construction, land clearing would cause about 275 tons of additional suspended sediment to be carried by Piceance Creek, which is insignificant when compared to the 13,000 tons currently being carried annually. Approximately 10 tons of salt annually would be deposited outside the project site by the cooling tower and would be washed into the White River by runoff. During the six month construction period for the Piceance Creek conduit, about 1,000 tons of salt would be added to Piceance Creek as a result of dewatering the alluvial aquifer.

Ultimate Effects

Based on the annual reduction of about 24,500 tons of salt and 600 acre-feet of water, the salt concentration as measured at Imperial Dam on the Colorado River would be reduced by about 2 mg/l during the life of the project (95 percent probability). Presently, there is an average annual 7,208,000 acre-feet discharge at Imperial Dam and a salt loading of about 9,173,055 tons; equating to a concentration of about 935 mg/l.

Annual direct and indirect benefit of reduced salinity in the Colorado River is about $230,000 per mg/l (*U.S. Bureau of Reclamation, 1974*). These benefits result from such savings as reduced costs for water treatment and increased crop yields. With an approximately 2 mg/l reduction in the concentration as a result of the proposed Superior project, an annual $460,000 benefit would accrue to downstream water users.

FLOODPLAIN MANAGEMENT

There would be project features located within the 100-year floodplain of Piceance Creek. The proposed action therefore falls within the guidance and direction provided in Executive Order (EO) 11988--Floodplain Management.

The primary reason for locating project features within the floodplain are the restrictive geology and topography of the area. Geology dictates the location of the proposed mine portal which would be situated east of Piceance Creek Road across Piceance Creek. Topography, with its deeply cut valley, restricts available working and storage space.

Proposed features have been designed with floodplain considerations. Superior delineated the 100-year floodplain (*Peak One Company, 1974*) and proposes to isolate features from potential flood by filling in and building up susceptible sites. Also, capacity would be provided in the proposed conduits to carry flood flows.

In addition to having capacity to carry the flow of a 100-year flood, the conduits would be designed and constructed to essentially eliminate backwater conditions and scouring of the streambed. Energy dissipaters would be constructed to slow the water velocity out of the conduits to nearly the same as naturally exists. To further protect the streambed from erosion, a lining of stone, or riprap, would be placed immediately downstream.

Alternate sites and features of the proposal were analyzed as part of the process reported in Chapter 8, Alternatives. No practical alternatives were found for features that would be located in the floodplain. The different schemes examined included altering the timing of mine development to reduce the area needed at the shale storage area, and relocating the function of the shale and process water storage area to other sites, such as, west of the proposed plant.

Both Rio Blanco County and the state exercise control over floodplain development. County control would primarily be exercised as a part of issuing the Special Use Permit as described in the Authorizing Actions section of Chapter 1. The state criteria and management standards are expressed in the 1977 Executive Order--Requirements and Criteria for State Participation in the National

Flood Insurance Program. In compliance with EO 11988, the patent conveying the public land to Superior would contain land-use restrictions as would pertain to state, county, and federal floodplain regulations. Maps delineating the floodplain and projected project features are included with copies of this ES to the county and state and are available for public review at the BLM--Colorado State Office.

SOIL

Total land requirement for the project, as shown in Table 1-8, is about 380 acres. About 30 acres of this total would be occupied by soil stockpiles. Assuming the remaining 350 acres would be exposed in about 1982, maximum soil movement would be about 1,100 tons. The sediment yield for the area is about 0.5 to 1 acre-foot of soil per square mile (*Colorado Land Use Commission, 1974*). An acre-foot of soil weighs about 2,000 tons. Assuming that 25 percent of the sediment would reach Piceance Creek, approximately 275 tons would be carried by the stream as suspended sediment affecting water quality.

VEGETATION

Construction and operation of the proposed project would effectively remove about 380 acres of vegetation and wildlife habitat; 15 acres of pinyon-juniper (PJ), 60 acres of sagebrush, 90 acres of greasewood, 30 acres of barren land, and 185 acres of cropland. Except for greasewood and cropland, which are 2 and 5 percent respectively, the acreages are less than 0.1 percent of the total acreage of these communities contained in the Piceance Planning Unit (*BLM, 197*).

Following the abandonment component of the proposed project, the 185 acres of cropland would be reestablished with alfalfa in about 3 years. The soil would be stabilized on the approximately 15 acres of former PJ acreage in about 15 years and about 5 years on the remaining acreage.

Ultimate Effects

Since there is no specific inventory for proposed endangered and threatened plant species, any one or all of the four plant species known to occur in Rio Blanco County could be disturbed and lost by project construction and operation (40 percent probability).

WILDLIFE

Throughout the life of the project, wildlife would be affected by the project and the resulting increased human activity in the area. Increased harassment, noise, hunting and poaching pressure, and collisions between animals and vehicles, especially with deer, would occur. However, the overall impact would not significantly alter animal populations or distribution, nor economic value of hunting in the area.

Displacement of species would be caused by the land and water requirements of the project and its related human growth. Assuming that animals are excluded from using the 380 acres that the project would disturb, plus a quarter-mile buffer around the area, maximum habitat displacement would be about 2,000 acres. The buffer would be created through avoidance of the area by the animals. These 2,000 acres represent less than 1 percent of the over 500,000 acres of similar habitat available in Piceance Creek.

Through construction of about 4,500 feet of conduit, approximately 8,000 feet, or 3 percent of the length, of Piceance Creek would be lost as aquatic habitat. While the annual discharge would be reduced (Table 3-28), water quality would be increased by the removal of about 24,500 tons of salt annually.

Increased deer mortality would occur through hunting and collisions with vehicles on highways in the project area. Assuming that one member from half of the new 3,155 households would hunt and half of those people would hunt the Piceance Basin, with a 58 percent success rate, about 460 additional deer from the Piceance Basin herd would be harvested annually.

During the life of the project, the average annual traffic volume would increase by about 70 percent over trended volume. Assuming the percentage of deer killed by vehicles is strictly proportional to increased traffic volume, the approximately 600 deer that are presently killed each year would be increased by about 420, making a total of about 1,020 deer killed from the Piceance Basin herd.

Annual human-caused deer mortality would increase from about 3,600 to about 4,480, or by about 24 percent. Direct project-related mortality of 880 would amount to about 2.5 percent of the 35,000 deer in the Piceance herd.

CHAPTER 4

MITIGATION

Measures described in this chapter are those that Superior is committed to carry out which are designed to eliminate or reduce the adverse impacts identified in Chapter 3.

1. Superior would be unable to dispose of waste generated by the proposed project at the Meeker disposal site. Therefore, Superior would develop a disposal area at the proposed project site. State and county permits would be required to assure that the facility is properly located and operated. The effect of this measure would be to eliminate, in 2007, about 30 trucks per day on road segment E (Figure 1-24), plus a lesser quantity of trucks throughout the life of the project. Also, about 64 additional acres would be disturbed at the project site.

2. Loss of data from the eight archaeological sites identified would be mitigated. The mitigation would be carried out in accordance with procedures mandated by Executive Order 11593, National Historic Preservation Act of 1966, and other statutes outlined in 36 CFR 800.1-.15.

Specific mitigating measures would be developed in consultation with the Colorado State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP). Generally, the procedures that BLM would follow in mitigating the impact are: 1) A determination of eligibility to the National Register of Historic Places would be made in coordination with the Colorado State Historic Preservation Officer (SHPO); 2) With the concurrence of the SHPO regarding eligibility, a nomination would be made; and 3) A Determination of Effect document, which is also called "106" and "Memorandum of Understanding," would be prepared outlining a plan of mitigation.

The proposed mitigation plan that would be presented is based on recovery of the data contained in the archaeological sites by Superior prior to any earth disturbance. Superior would be bound to perform the work through a contract with the BLM. This contract would specify how and when the work would be performed. In order to assure that the work is carried out in the manner specified, BLM would retain the right to inspect the work and, if necessary, carry out the data recovery.

Before a final mitigation plan is accepted it would have the concurrence of the SHPO, ACHP, and Superior. The means for obtaining the concurrence is contained within the general procedures listed above. Effectiveness of the measures adopted would be to recover all significant data from the sites.

3. Project construction and operation could disturb plants proposed as threatened and endangered. In order to assert the absence or presence of the plants in the project area, BLM would inventory areas that would be affected by the proposal prior to the land exchange. If any of the plants are located, the U.S. Fish and Wildlife Service would be consulted, in accordance with Section 7 of the Endangered Species Act.

CHAPTER 5

UNAVOIDABLE ADVERSE IMPACTS

Adverse impacts from Chapter 3 are discussed below. The results of the mitigation measures from Chapter 4 have been incorporated. Impacts are adverse or beneficial, depending on points of view. The discussion in this chapter considers impacts from a strict adverse standpoint.

SOCIOECONOMICS

Other industries in the region, including agriculture, would be disrupted by people being drawn away from their present employments to new higher paid jobs associated with the proposed project.

The approximately 68 percent higher wages and demand from the new population would inflate the costs of goods and services, including housing. The spending power of those benefiting from the higher wages would be reduced. Those on fixed income would be forced to spend more of their incomes on subsistence, thereby lowering their quality of life, or be forced from the area.

Some local business people would be forced out of business because they would be either unable or unwilling to expand to accommodate the new demand and buying preferences of the new population, or be faced with overwhelming competition from larger franchises and other larger operations.

A tight housing situation would force some to live in temporary housing, creating a lower quality of life for those forced to do so, while at the same time, increase the costs to the communities for providing services.

Sprawl would increase the overall cost of providing community services and reduce the quality of the environmental setting of the area.

About 450 houses, or about 15 percent of the total, would be vacated at the end of the proposed project. The value of all housing in the area would be lowered in terms of investment and degrading neighborhoods.

Costs of providing community services to the new population at the present level would exceed revenues in Garfield County, Rifle, Rangely, Meeker, and in the Rifle and Rangely School Districts. The level of services would be lowered, or taxes increased, to make up the deficit. Either action would decrease the quality of life, especially for those on fixed incomes. In the two affected school districts, the quality of education would be lowered.

The ongoing trend from agricultural-type lifestyle to an industrial-type lifestyle would be accelerated. The way-of-life would be suburban versus the present rural.

Social factions and group isolation would occur between the new population and those presently living in the area.

Mental well-being of the population would be adversely affected by reduced air quality, increased traffic and noise, altered appearance of the towns, and the loss of the feeling of remoteness.

LAND USE

Recreational quality of the area would be reduced by increased traffic and noise, decreased air quality, and additional people using the area for recreation.

As a result of the land exchange, two ranches would each lose approximately $5,600 in gross revenues and $1,100 in net revenues. The impact on the ranching operations would either force the ranchers out of business entirely or force them to increase their subsidy for operating the ranches.

HIGHWAY SYSTEM

Average daily traffic would increase by about 70 percent. The cost of highway maintenance for the state and Rio Blanco County would also increase. Traffic congestion would be a safety hazard and cause drivers to become more frustrated.

NOISE

Increased traffic would generate noise along the highway system. People along the highway would be subjected to startling reactions, behavioral interference, and subjective effects such as annoyance. Property values would be lowered in those areas affected by noise. Wildlife habitats would also be altered.

VISUAL RESOURCES

Project facilities and reduced visibility caused by decreased air quality would dominate two classes

of landscape where the management objectives are--in one class, changes should not be evident or attract attention, and in the other class, changes should be subordinate.

CULTURAL RESOURCES

While the scientific information from the eight archaeological sites would be recovered as described in Chapter 4, some data would not be recovered due to present day technological limitations.

With the increased number of people in the area and their associated activities, including vandalism and recreational vehicle use, the integrity of the area's cultural resources would be reduced.

CLIMATE AND AIR QUALITY

During project construction, the total suspended particulate concentration would exceed the Class II Prevention of Significant Deterioration increments. The increment would be about 96 micrograms per cubic meter ($\mu g/m^3$), while the allowable increment is 37.

Present levels of non-methane hydrocarbons, at 220 $\mu g/m^3$, exceeds ambient standards, which are 160 $\mu g/m^3$. Superior's project would add another 15 $\mu g/m^3$ to this quantity.

GEOLOGY AND MINERALS

About 45 percent of the mineral resources that would be mined would not be recovered with current technology. This amounts to about 19 million tons of nahcolite, 59 million barrels of shale oil, 0.5 million tons of alumina, and 3 million tons of soda ash.

WATER RESOURCES

Project water uses and the domestic-water requirements of the new populations in Meeker and Rangely would reduce the average annual flow of the White River by about 600 acre-feet, or about 0.1 percent, as would be measured below Rangely.

SOIL

During initial construction of the project about 1,100 tons of soil would be displaced. About 275 tons of that soil would reach Piceance Creek and be carried as suspended sediment.

As discussed in Chapter 4, Superior would develop a 64-acre waste disposal area at the project site. Approximately 90 percent of the volume of waste to be disposed would occur within the last two years of the project (Table 3-13). Total soil movement would be about 200 tons with about 50 reaching Piceance Creek.

VEGETATION

A total of approximately 444 acres of vegetation, which serves as wildlife habitat, would be removed by the proposed project. About 380 acres of vegetation would be removed during construction, while another 64 acres would be removed with the development of the on-site waste disposal area.

WILDLIFE

Wildlife would be affected by removal of habitat, increased human harassment, noise, hunting and poaching pressure, and collisions with vehicles.

Displacement of wildlife would occur by excluding access to about 2,000 acres of habitat; 444 acres of vegetation removed during project construction and operation, plus an approximately one-quarter mile buffer around the proposed project site.

Approximately 8,000 feet of Piceance Creek would be lost as aquatic habitat with construction of the 4,500 feet of conduit.

Increased hunting pressure would remove about 460 deer annually. Approximately 420 additional deer would be killed as a result of collisions with vehicles.

CHAPTER 6

SHORT- AND LONG-TERM RELATIONSHIPS

CUMULATIVE IMPACTS

Projects of other agencies and private companies would have impacts on some of the same components of the environment as would the proposed Superior project. The information contained in this section is presented within the time frame of the Superior proposal even though the projects would extend past the lifetime of Superior. This has been done because their importance in this ES is only how they significantly relate to the proposal in terms of cumulative impacts.

Interrelated Projects

Seven projects have the potential to develop and affect some of the same environmental components as would the Superior proposal. The six projects that would be located in the vicinity of Piceance Basin are shown in Map 6-1. The other project, Anschutz, is located outside the area but is included since it would influence the population in the project area. Definite information is not available because the projects are in various stages of planning and development. Therefore, some assumptions have been made based on similar projects and professional judgements.

There would be three oil shale developments. Paraho would have an above ground oil recovery unit while Ca and Cb would be underground, or in situ (*Gulf and Standard, 1977, and Ashland and Shell, 1976*). Essentially, all three projects are prototype oil shale development projects located on public land. Shale oil that would be produced at Paraho would be shipped by train from Rifle, Colorado. Approximately 6 rail cars per day would be required. This is equivalent to about 1 train every 12 days consisting of 75 cars per train. A pipeline would connect Ca and Cb with existing pipeline facilities at Rangely.

The Moon Lake Electrical Association would construct a 500 megawatt capacity coal fired electrical generator. Coal would be supplied both by a mine in the immediate vicinity, and trucked in from other sources. Water, approximately 76,000 gallons per day, for the plant would be supplied from an adjacent reservoir.

Colowyo, Anschutz, and Mid-Continent are coal development projects. Coal produced from Anschutz and Mid-Continent would be trucked to Carbondale, Colorado, which is outside the Superior project area, for rail shipment. To ship its coal, Colowyo is currently constructing an approximately 16-mile rail spur from Craig, Colorado.

Projected employment, traffic, production rates, and air emission data are shown in Tables 6-1, 6-2, 6-3, and 6-4, respectively.

Impact Analysis

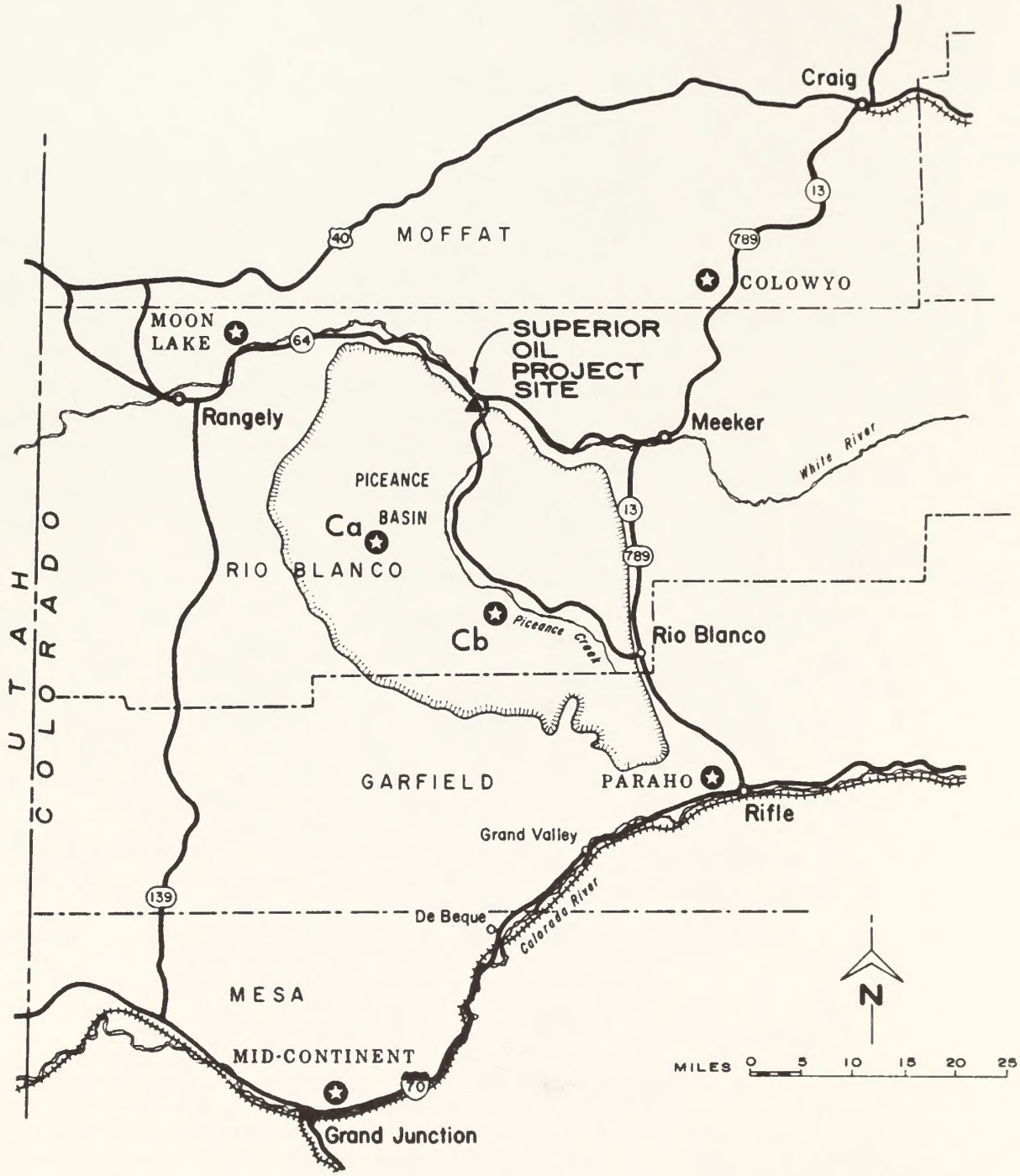
Impacts that would result from implementation of the Superior and interrelated projects are basically identical to those described in Chapter 3 and are not duplicated entirely in this chapter. Major differences are in terms of magnitude. The same methods and assumptions used in Chapter 3 were also used in this section.

Socioeconomics

Total annual incomes by residence are shown in Table 6-5. Projected new populations for Garfield and Rio Blanco Counties are shown in Table 6-6. Populations for Rifle, Rangely, and Meeker are shown in Table 6-7. As a result of higher incomes and the influx of people, the local economy would be inflated. The average standard of living would increase, as would business activity. However, those on fixed incomes would not benefit from the increase and could be forced to migrate out, as would those businesspeople unable to compete.

Housing requirements, as shown in Table 6-8, would not stabilize until about 1990. The type of dwelling units required are shown in Table 6-9. Inflation would result from the increased demand. Costs of financing would not be as great as with Superior only, due to short repayment periods, but demand for financing monies would still inflate this cost. Temporary housing and the potential for sprawl would also increase. Upon abandonment of the Superior project, the 450 housing units that would be vacated would represent only 7 percent of the total housing, and would mitigate the impacts of lowering other property values and degradation of neighborhoods.

Projected costs that would be associated with providing the new population with community services are shown in Tables 6-10 through 6-17.



LOCATION MAP OF INTERRELATED PROJECTS

MAP 6-1

Project	Employment/Year 1982	1983	1984	1985	1990	1995-2010
Ca	550	1,300	2,300	2,500	2,000	1,700
Cb	2,098	1,774	1,600	1,600	1,600	1,600
Paraho	350	350	350	350	350	350
Moon Lake	1,200	100	100	100	100	100
Colowyo	220	220	220	220	220	220
Anschutz	180	180	180	180	180	180
Mid-Continent	40	40	40	40	40	40
Total	4,638	3,964	4,790	4,990	4,490	4,260

Note:

The years correspond to the time frame for the proposed Superior Oil project (Figure 1-2).

EMPLOYMENT FOR INTERRELATED PROJECTS

TABLE 6-1

Project	Road Segment(s)	Truck Traffic/Year 1982	1983	1984	1985	1986-2008
Ca	A, B_1	12	12	0	0	20
Cb	A, B_1	120	137	120	194	120
Moon Lake	F	220	220	220	220	220
Total		352	369	340	414	360

Note:

See Figure 1-24 for location of the road segments.

The years correspond to the time frame of the proposed Superior Oil project (Figure 1-2).

INTERRELATED TRUCK TRAFFIC FOR ROAD SEGMENTS A, B_1, AND F

TABLE 6-2

Projects	Units	Average Daily Production 1982-2008	Average Annual Production
Ca	Barrels of shale oil	50,000	18,250,000
Cb	Barrels of shale oil	50,000	18,250,000
Paraho	Barrels of shale oil	6,000	2,190,000
Moon Lake	Megawatts of electricity	500	182,500
Colowyo	Tons of coal	8,200	2,993,000
Anschutz	Tons of coal	55	20,075
Mid-Continent	Tons of coal	200	73,000

Note:

The years correspond to the time frame of the proposed Superior Oil project.

PRODUCTION RATES FOR INTERRELATED PROJECTS

TABLE 6-3

Pollutant	Air Emissions (ave. lbs/hr) Ca	Cb	Moon Lake Electric
Total Suspended Particulates	27.8	78.3	262
Sulfur dioxide	85.1	28.0	860
Nitrogen Oxides	249.7	446.0	1,836
Carbon Monoxide	71.1	3,872.7	125
Hydrocarbons	9.1	35.8	37
No. of Units	5	6	4

Note:

Source for Ca; Public Notice of Proposed Conditional Permit to Commence Construction and Operate Prevention of Significant Deterioration of Air Quality - Review of New Sources, Rio Blanco Oil Shale Project, Rio Blanco County, Colorado.

Source for Cb; Ashland Oil, Inc., and Occidental Oil Shale, Inc., Air Quality Control Plan for Tract Cb, July 21, 1977.

Source for Moon Lake Electric; Environmental Impact Statement; Northwest Colorado Coal, Bureau of Land Management, U.S. Department of the Interior, 1976.

AIR EMISSIONS FROM OIL SHALE TRACTS Ca AND Cb AND MOON LAKE ELECTRIC POWER PLANT

TABLE 6-4

Year	Garfield County Total County	Garfield County Rifle Only	Rio Blanco County Total County	Rio Blanco County Rangely Only	Rio Blanco County Meeker Only
1980	45,156,592	29,875,204	28,070,167	3,962,993	22,283,871
1981	50,844,166	34,439,876	45,553,435	15,467,958	26,245,386
1982	52,716,830	35,264,657	74,777,599	37,832,285	32,523,288
1983	53,269,148	34,631,883	63,192,178	25,074,601	34,520,332
1984	74,476,758	47,562,960	94,379,977	42,898,329	45,910,634
1985	79,548,482	50,823,354	107,621,681	47,668,265	54,133,642
1990	72,846,561	46,626,200	88,541,937	38,488,704	45,190,012
1995	71,185,269	45,645,516	83,349,500	34,942,347	43,823,787
2000	71,185,269	45,645,516	83,349,500	34,942,347	43,823,787
2010	66,664,223	42,625,073	72,987,304	33,031,497	35,859,784

TOTAL ANNUAL INCOME OF BASIC AND NON-BASIC EMPLOYEES BY RESIDENCE (1977 DOLLARS)

TABLE 6-5

Year	New Garfield County Population				New Rio Blanco County Population			
	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.
1980	22,122	3,183	3,438	28,743	5,379	1,999	1,974	9,353
1981	23,070	3,580	3,867	30,518	5,459	3,232	3,190	11,882
1982	24,018	3,714	4,010	31,743	5,539	5,288	5,219	16,046
1983	24,966	3,751	4,056	32,774	5,619	4,474	4,416	14,509
1984	25,914	4,132	6,761	36,808	5,698	6,356	7,058	19,112
1985	26,862	4,412	7,267	38,542	5,778	7,279	8,083	21,141
1990	31,603	4,043	6,650	42,295	6,177	5,993	6,655	18,824
1995	36,343	3,922	6,454	46,718	6,574	5,535	6,146	18,256
2000	41,083	3,922	6,454	51,458	6,974	5,535	6,146	18,654
2010	50,563	3,767	6,188	60,518	7,771	5,054	5,612	18,437

Note:

Basic employment is that directly associated with the proposed Superior Oil and interrelated projects.

8y the year 2010, approximately 40 percent of Superior and directly related non-basic employees have been assumed to migrate out of the area.

PROJECTED NEW POPULATION FOR GARFIELD AND RIO BLANCO COUNTIES WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-6

Year	New Rifle Population				New Rangely Population				New Meeker Population			
	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.	Trended Pop.	Basic Employ. Pop.	Non-Basic Employ. Pop.	Total New Pop.
1980	2,633	2,105	2,078	6,815	1,974	275	271	2,520	1,947	1,575	1,555	5,077
1981	2,745	2,425	2,394	7,565	2,004	1,078	1,064	4,145	1,976	1,931	1,906	5,814
1982	2,858	2,484	2,452	7,794	2,033	2,601	2,567	7,201	2,005	2,353	2,322	6,680
1983	2,971	2,439	2,408	7,818	2,062	1,656	1,635	5,353	2,034	2,542	2,509	7,085
1984	3,084	2,639	4,559	10,283	2,091	2,687	2,984	7,763	2,063	3,229	3,664	9,026
1985	3,197	2,821	4,873	10,890	2,121	2,896	3,216	8,233	2,092	3,969	4,408	10,469
1990	3,761	2,588	4,470	10,818	2,267	2,374	2,636	7,277	2,236	3,270	3,631	9,137
1995	4,325	2,515	4,345	11,185	2,413	2,060	2,288	6,761	2,380	3,149	3,497	9,027
2000	4,778	2,515	4,345	11,749	2,559	2,060	2,288	6,907	2,524	3,149	3,497	9,171
2010	6,017	2,401	4,166	12,584	2,852	1,968	2,186	7,006	2,813	2,782	3,090	8,685

Note:

Basic employment is that directly associated with the proposed Superior Oil and interrelated projects.

By the year 2010, approximately 40 percent of Superior and directly related non-basic employees have been assumed to migrate out of the area.

PROJECTED NEW POPULATIONS FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-7

Year	Rifle	Rangely	Meeker
1980	45	12	361
1981	264	381	273
1982	85	852	321
1983	80	39	150
1984	855	78	349
1985	109	22	532
1990	203	45	54
1995	204	44	58
2000	233	47	53
2010	407	93	107
Total	2,485	1,612	2,258

Note:

The source for the trended and Superior dwelling units is Table 3-9.

PROJECTED NEW HOUSING REQUIREMENTS FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-8

	Rifle				Rangely				Meeker			
Year	SUD	MUD	MH	TEMP.	SUD	MUD	MH	TEMP.	SUD	MUD	MH	TEMP.
1980	29	5	11	-	9	1	2	-	267	36	58	-
1981	172	27	66	-	282	38	61	-	202	27	44	-
1982	55	8	21	-	631	85	136	113	238	32	51	-
1983	52	8	20	-	29	4	6	-	111	15	24	-
1984	555	85	214	-	58	8	12	79	258	35	56	-
1985	71	11	27	89	16	2	3	324	394	53	85	374
1990	132	20	51	-	33	5	7	-	40	5	9	-
1995	133	20	51	-	33	4	7	-	43	6	9	-
2000	152	23	58	-	33	5	7	-	39	5	9	-
2010	265	41	101	-	69	9	15	-	79	11	17	-
TOTAL	1,616	248	620	89	1,193	161	256	516	1,671	225	362	374

Note:

Number of single unit (SUD), multiple unit (MUP), mobile home (MH), and temporary (temp.) dwellings by community.

The source for the Superior Oil population needs, and those of the trended population, is Table 3-10.

TOTAL PROJECTED TYPE OF DWELLING UNITS REQUIRED FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-9

Revenues are also shown in these tables. Only in Rio Blanco County and the Meeker School District will revenues exceed costs. Rifle would experience excess revenues until about 1990. The level of service would decrease, or taxes would increase, to make up the deficits of the other entities. People would be encouraged to settle outside the jurisdictions of these entities and the overall economic potential would be decreased.

Highway System

As shown in Table 6-18, the capacity of Piceance Creek Road would be exceeded during the maximum peak hour. The capacity would drop from a service level "C" to "D". The average speed would drop from about 50 miles per hour to 40. Overall, maintenance costs for the highway system would increase as would congestion.

Noise

Noise levels in the project area would increase as shown in Table 6-19. The highest level would be along Piceance Creek Road with an increase of 10 decibels over present conditions. The people along the highway system would experience psychological impacts as well as a potential lowering of value of their property.

Climate and Air Quality

During operation of the proposed Superior project and the operation of interrelated projects, annual state and federal ambient air quality standards would not be exceeded (Table 6-20). Excess nitrogen oxides would reduce average visibility from about 75 miles to 50 but only within a radius of about a mile around the proposed plant.

RISKS TO HEALTH AND SAFETY

Human safety risks that would be directly associated with the proposed Superior project, as described in Chapter 1, are traffic accidents and mine and plant accidents. Projected highway accidents by road segments are shown in Table 6-21. The road segments are located in Figure 1-24. Deaths would surely occur; however, the State Highway Department bases fatality rates on deaths per ten million miles driven which would not show up, statistically, in this analysis.

Projected mine and plant accident statistics are shown in Table 6-22. The rates are based on injury and fatalities per million man hours.

NET ENERGY ANALYSIS

A comparison was made between the net energy that would be required for Superior to produce its products and the net energy of producing the same product by other processes (*Colorado School of Mines Research Institute, 1979*). The comparison, which is summarized in Table 6-23, indicates that the proposed Superior process has more desirable net energy characteristics.

TRENDS SIGNIFICANTLY IMPACTING ENVIRONMENTAL VALUES

The proposed Superior project would result in the following trends:

1. Industrialization of the area and the feasibility of developing oil shale resources.
2. Movement of potential employees from lower paying jobs, such as agricultural, disrupting those industries.
3. Driving up the costs of goods and services in an area now experiencing a "comparatively" stable economy.
4. Increasing the overall standard of living.
5. Moving the agricultural or rural-type lifestyle to a more industrial type.
6. Increasing use demand on man-made and natural resources of the area including its highway, community services, water, land, and biology.

SHORT- AND LONG-TERM BENEFITS

Short-term benefits are defined as those occurring during the nearly 30-year life of the proposed Superior project. Benefits following that time period are considered long-term. Listed below are the significant benefits of the proposed project and the tradeoffs of gaining those benefits.

1. SHORT-TERM--The proposed project would provide new direct and indirect employment and income opportunity to an area with a scarcity of jobs and low-income levels. Overall, the quality of life would increase.
2. LONG-TERM--New technology would be developed and proven for recovery of the oil shale resources. Energy and minerals from the oil shale would become more economically and environmentally feasible.
3. TRADEOFF--An area that is now rural would become industrial. Small town atmosphere and the associated quality of life would be lost. The "clean" air, open spaceness, and solidarity would diminish.

	COSTS ($)			REVENUES ($)		
Year	Capital	O&M	Total	Property	Other	Total
1980	1,198,401	125,799	869,730	594,773	754,794	1,349,567
1981	1,347,907	141,493	968,110	619,518	878,958	1,468,476
1982	1,398,044	146,756	1,004,120	615,110	880,536	1,495,646
1983	1,413,067	148,333	1,014,910	606,774	889,988	1,496,762
1984	1,971,633	206,967	1,416,090	730,444	1,241,802	1,972,246
1985	2,113,899	221,901	1,518,270	717,700	1,331,406	2,049,106
1990	1,935,433	203,167	2,138,600	679,468	1,219,002	1,898,470
1995-2010	1,935,433	197,144	2,075,200	679,468	1,182,864	1,862,332

COST AND REVENUE ANALYSIS FOR GARFIELD COUNTY
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-10

	COSTS ($)			REVENUES ($)		
	Capital	O&M	Total	Property	Other	Total
1980	719,113	75,487	516,490	299,191	452,922	752,113
1981	1,162,382	122,018	334,860	415,491	732,108	1,147,599
1982	1,901,767	199,633	1,365,910	940,207	1,197,798	2,138,005
1983	1,609,090	168,910	1,155,700	972,862	1,013,460	1,986,322
1984	2,427,934	254,866	1,743,820	1,059,476	1,529,196	2,588,672
1985	2,780,522	291,878	1,997,060	1,006,496	1,751,268	2,757,764
1990	2,289,288	240,312	2,529,600	1,209,538	1,441,872	2,651,410
1995-2010	2,114,261	221,939	2,336,200	1,163,018	1,331,634	2,494,652

COSTS AND REVENUE ANALYSIS FOR RIO BLANCO COUNTY WITH
THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-11

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	1,087,580	117,124	783,058	213,438	156,157	284,444	654,039
1981	1,252,940	134,932	902,117	245,889	180,013	327,692	753,594
1982	1,283,306	138,208	924,019	251,859	184,330	335,648	771,837
1983	1,260,220	135,716	907,358	247,318	181,021	329,596	757,935
1984	1,871,480	201,544	1,347,466	350,032	248,612	489,464	1,088,108
1985	2,000,440	215,432	1,440,317	350,032	265,652	523,192	1,138,876
1990	1,835,080	197,624	2,032,704	350,032	243,714	479,944	1,073,690
1995-2010	1,783,600	192,080	1,975,680	350,032	238,592	466,480	1,055,104

COSTS AND REVENUE ANALYSIS FOR RIFLE
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-12

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	141,960	15,288	102,211	38,288	9,416	51,870	99,574
1981	556,920	59,976	400,982	83,602	36,750	203,490	323,842
1982	1,343,680	144,704	967,450	169,702	89,889	490,960	750,551
1983	855,660	92,148	616,075	169,702	59,578	312,645	541,925
1984	1,474,460	158,788	1,061,611	169,702	101,926	538,745	810,373
1985	1,589,120	171,136	1,144,166	169,702	113,259	580,640	863,601
1990	1,302,600	140,280	1,442,880	169,702	91,450	475,950	737,102
1995-2010	1,302,600	121,744	1,252,224	169,702	83,022	413,060	665,784

COSTS AND REVENUE ANALYSIS FOR RANGELY
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-13

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	813,800	87,640	585,936	153,683	58,228	256,660	468,571
1981	998,920	107,576	719,222	188,642	71,191	315,044	574,877
1982	1,137,500	122,500	819,000	226,319	84,983	383,350	694,652
1983	1,313,260	141,428	945,547	226,319	90,201	414,182	730,702
1984	1,810,380	194,964	1,303,474	226,319	119,963	570,966	917,248
1985	2,178,020	234,556	1,568,174	226,319	141,452	686,914	1,054,685
1990	1,794,260	193,228	1,987,488	226,319	118,081	565,882	910,282
1995-2010	1,727,960	186,088	1,914,048	226,319	114,512	544,972	885,803

COSTS AND REVENUE ANALYSIS FOR MEEKER
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-14

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Total
1980	375,314	1,322,592	1,697,906	1,315,126	1,315,126
1981	375,314	1,517,172	1,892,486	1,363,539	1,363,539
1982	375,314	1,508,928	1,884,242	1,345,437	1,345,437
1983	375,314	1,599,420	1,974,734	1,321,160	1,321,160
1984	375,314	2,389,608	2,764,922	1,619,211	1,619,211
1985	375,314	2,571,492	2,946,806	1,585,533	1,585,533
1990	375,314	2,330,544	2,705,858	1,484,499	1,484,499
1995-2010	375,314	2,251,884	2,627,198	1,484,499	1,484,499

COSTS AND REVENUE ANALYSIS FOR THE RIFLE SCHOOL DISTRICT (RE-2)
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-15

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Total
1980	214,130	164,772	378,902	52,107	52,107
1981	214,130	632,868	846,998	134,058	134,058
1982	214,130	1,521,036	1,735,166	716,216	716,216
1983	214,130	985,872	1,200,002	781,988	781,988
1984	214,130	1,611,840	1,825,970	763,844	763,844
1985	214,130	1,798,140	2,012,270	670,856	670,856
1990	214,130	1,475,220	1,689,350	496,220	496,220
1995-2010	214,130	1,284,780	1,498,910	496,220	496,220

COSTS AND REVENUE ANALYSIS FOR THE RANGELY SCHOOL DISTRICT (RE-4)
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS)

TABLE 6-16

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Total
1980	313,150	931,776	1,244,926	1,713,637	1,713,637
1981	313,150	1,140,984	1,454,134	2,079,760	2,079,760
1982	313,150	1,378,896	1,692,046	2,433,413	2,433,413
1983	313,150	1,467,768	1,780,918	2,514,905	2,514,905
1984	313,150	2,026,392	2,339,542	3,123,908	3,123,908
1985	313,150	2,441,772	2,754,922	3,292,505	3,292,505
1990	313,150	2,015,628	2,328,778	6,064,603	6,064,603
1995-2010	313,150	1,938,900	2,252,050	5,716,943	5,716,943

COSTS AND REVENUE ANALYSIS FOR THE MEEKER SCHOOL DISTRICT (RE-1)
WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS
(CONSTANT 1977 DOLLARS

TABLE 6-17

Year	Road Seg.	AVG. PEAK HOUR TPH	CAP	TPH as Coeff. of CAP	MAX. PEAK TPH	TMP as Coeff. of CAP
1980	A	340	1,100	.31	520	.47
	B_1	340	500	.68	530	1.06
	B_2	30	500	.06	50	.10
	C	300	1,100	.27	610	.55
	D	150	1,100	.14	300	.27
	E	90	820	.11	160	.20
	F	110	820	.13	190	.23
1985	A	585	1,100	.53	790	.73
	B_1	342	500	.65	492	.98
	B_2	182	500	.36	242	.48
	C	473	1,100	.40	783	.72
	D	197	1,100	.18	387	.35
	E	628	820	.77	758	.92
	F	296	820	.36	426	.52
1990	A	451	1,100	.41	641	.58
	B_1	360	500	.72	550	1.10
	B_2	130	500	.26	190	.38
	C	281	1,100	.26	531	.48
	D	167	1,100	.15	327	.30
	E	329	820	.40	459	.56
	F	223	820	.27	353	.43
1995	A	441	1,100	.40	631	.57
	B_1	370	500	.74	560	1.12
	B_2	90	500	.28	200	.40
	C	341	1,100	.31	651	.60
	D	167	1,100	.13	287	.26
	E	319	820	.39	359	.54
	F	213	820	.17	313	.26
2000	A	431	1,100	.48	621	.66
	B_1	370	500	.74	560	1.12
	B_2	140	500	.28	210	.42
	C	351	1,100	.32	691	.61
	D	147	1,100	.13	287	.26
	E	319	820	.39	349	.52
	F	203	820	.25	323	.39
2005	A	451	1,100	.41	641	.59
	B_1	380	500	.76	570	1.14
	B_2	150	500	.30	210	.42
	C	351	1,100	.32	690	.61
	D	187	1,100	.13	287	.26
	E	319	820	.39	439	.54
	F	203	820	.25	323	.39
2007	A	431	1,100	.39	641	.58
	B_1	366	500	.73	560	1.13
	B_2	106	500	.21	166	.33
	C	380	1,100	.35	750	.68
	D	160	1,100	.15	320	.29
	E	181	820	.22	291	.37
	F	158	820	.19	278	.34

NOTE: TPH = Total Peak Hour Traffic-Existing and Trended + Superior + Interrelated Projects
CAP = Capacity-Volume at Service Level "C"
TPH = Total Maximum Peak Hour Traffic-Existing and Trended + Superior + Interrelated Projects

PEAK HOUR TRAFFIC VOLUME TO CAPACITY FOR ROAD SEGMENTS IN THE PROJECT AREA WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-18

a. Decibel (dba) at 50 Feet

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	67.2	70.1	69.6	69.6	69.7	69.8	68.8
B_1	62.7	67.2	66.4	66.4	66.4	66.4	66.4
B_2	52.7	62.7	61.4	62.6	61.9	61.9	58.3
C	66.8	68.1	68.3	68.5	68.7	69.0	68.9
D	65.9	67.0	67.2	66.5	66.5	66.7	66.8
E	63.3	68.1	67.9	67.9	67.9	68.0	66.5
F	65.2	69.1	69.6	69.7	69.8	69.8	69.1

b. Distance in Feet to the 50 dba Contour

Road Segment	Year 1980	1985	1990	1995	2000	2005	2007
A	360	500	480	480	480	480	440
B_1	210	360	335	335	335	335	335
B_2	70	215	185	215	200	200	125
C	345	400	420	425	430	450	450
D	320	350	360	335	335	340	340
E	235	400	400	400	400	400	335
F	285	450	475	480	485	485	450

NOISE LEVELS IN THE PROJECT AREA WITH THE PROPOSED SUPERIOR OIL AND INTERRELATED PROJECTS

TABLE 6-19

Pollutant	Federal Ambient Standards (Primary)	PSD Class II Increment	Exist. Level at the Site	Superior Increment	Other Projects Increment	Total New Concentrations (Rounded)
Total Suspended Particulates (annual)	75	19	11	8	1.5	21
Sulfur Dioxide	80	20	10	1	2.7	14
Nitrogen Oxides	100	-	10	12	10.0	32

Note:

Construction TSP emissions were not considered because of their temporary nature.

PREDICTED MAXIMUM ANNUAL AVERAGE POLLUTANT CONCENTRATIONS AT THE PROPOSED SUPERIOR SITE ($\mu g/m^3$)

TABLE 6-20

Time Period	Road Segment A	C	D	E	F
1985-1989	43	17	12	78	27
1990-1994	46	24	19	42	21
1995-1999	46	24	19	42	21
2000-2004	46	24	19	42	21
2005-2006	41	20	19	38	21
2007	19	16	13	8	7

Note:

Source for the baseline data; State Highway Department Accident Reports - no data is available for road segment B.

The method used to derive the figures was; Superior's average daily traffic x 365 days x average accident rate (road segment) divided by one million.

PROJECTED AVERAGE ANNUAL TRAFFIC ACCIDENTS
BY ROAD SEGMENT
WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 6-21

Time Period	Mine		Plant		Total	
	Accidents	Fatalities	Accidents	Fatalities	Accidents	Fatalities
1985-1989	18	.38	11	.05	29	.44
1990-1994	18	.38	11	.09	29	.47
1995-1999	18	.38	11	.09	29	.47
2000-2004	18	.38	11	.09	29	.47
2005	18	.38	11	.09	29	.47

Note:

The figures are based on rates per million man hours from "Mining Underground Except Coal" and "Non-Ferrous Metals and Products" as contained in the National Safety Council publication "Accident Facts" (1977).

PROJECTED AVERAGE ANNUAL MINE AND PLANT ACCIDENT AND FATALITY
RATES WITH THE PROPOSED SUPERIOR OIL PROJECT

TABLE 6-22

Item	Quantity	External Energies	
		Superior: Purchased plus internally recycled	Comparison: Entirely purchased
Nahcolite Product	4,878 tons	3.7×10^9 Btu	3.7×10^9 Btu
Oil Product	11,586 bbl	8.7×10^9 Btu	10.1×10^9 Btu
Soda Ash Product	1,005 tons	6.5×10^9 Btu	7.2×10^9 Btu
Alumina Product	580 tons	5.0×10^9 Btu	12.8×10^9 Btu
External Energies			
Gross total		23.7×10^9 Btu	33.8×10^9 Btu
Less internally recycled		11.2×10^9 Btu	0
Net external energies		12.5×10^9 Btu	33.8×10^9 Btu
Total External Energies plus Losses of Intial Process Energy		46.6×10^9 Btu	66.4×10^9 Btu
Total process plus External Energy Inputs		116.3×10^9 Btu	136.1×10^9 Btu

Note:

8tu = British thermal unit--The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Initial process energy in oil shale for the proposed Superior operation is 103.8×10^9 Btu and 101.9×10^9 Btu for comparison operation.

Both Superior and comparison oil shale retorts recycle some energy which has been excluded from the data of this table.

EXTERNAL AND PRINCIPAL ENERGIES FOR THE PRODUCT MIX OF THE PROPOSED SUPERIOR OIL PROCESS AND COMPARABLE PROCESSES

TABLE 6-23

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This chapter discusses the commitment of resources that would be made by the project in terms of being irreversible or irretrievable. Irreversible commitments are those not capable of being reversed. Irretrievable means not recoverable or, once used, not readily replaceable.

IRREVERSIBLE

Land Use

The new populations associated with the proposed project would require land for community services and housing. Community services include building sites, parks, and waste disposal areas. Approximately 430 acres would be developed in Rifle, 190 in Rangely, and 370 in Meeker.

Approximately 435 acres would be required for the project--380 acres for the mine and plant (Table 1-8) and 65 acres for solid waste disposal. This requirement would be during the life of the project.

IRRETRIEVABLE

Socioeconomics

Approximately $300 million would be invested into project facilities. Another $110 million would be paid to employees throughout the life of the project. Man-years of labor would be about 22,500. In addition to highway-accident deaths, a total of about 10 people are projected to be accidentally killed while working at the project.

Lifestyles would be altered from "rural" to industrial. Perceived environmental elements including noise, air quality, and aesthetics, would be committed.

Land Use

Approximately 100 acres at the Superior project site would be irretrievably committed. The acreage is that associated with a disposal area and other features, such as the muck pile, that would remain in place after the project is completed.

Cultural Resources

Information not collected from the archaeological sites, because of technological and other limitations, would be irretrievable.

Geology and Minerals

Quantities of mineral resources would be left unrecoverable with current technology; about 19 million tons of nahcolite compared to 29 billion tons estimated to be contained in Piceance Basin; 59 billion barrels of oil compared to about 1,200 billion barrels; and 10 million tons of dawsonite compared to 19 billion tons.

Wildlife

Over the life of the proposed project about 26,000 deer would be lost. About half of this number represents vehicle-related causes and the other half represents increased hunting pressure.

Energy and Minerals

Approximately 116 billion British thermal units (Btu's) would be used by the project (Table 6-23). The forms of this energy include electricity, gasoline, and diesel. Materials and their quantities that would be committed to by the project are steel--28,000 tons, concrete--188,000 tons, and lumber--450,000 board feet. These quantities do not include the processing units and other fabricated items shipped to the site.

CHAPTER 8

ALTERNATIVES

Presented in this chapter are those alternatives technically available and reasonably possible. Several others were evaluated which did not meet this criteria or presented no significant change in environmental impacts as discussed in Chapter 3. These "others" included delaying the land exchange; competitive leasing of the public land proposed in the exchange; exchange of mineral estates only; and locations, timing, and purposes of the several project features, principally the shale and process water storage area.

In the analysis of alternatives the baseline presented in Chapter 2 was used, as were the assumptions and methods contained in Chapter 3. Except for the No Action alternative, the impacts of the alternatives were found to be basically identical to those identified in Chapter 3 and are not duplicated entirely in this chapter. Magnitude and duration are the major differences.

NO ACTION

Without the proposed land exchange and the logical mining unit it would create for Superior, there would not be a project. The area would continue much as it is today except for the changes brought about by natural trends. These trends are discussed in Chapter 2--Description of the Environment.

Population growth would continue at its modest rate. The agricultural economies and social bases would continue to decline in light of the mining industry upswing. While lifestyles would be altered, the change would be gradual and mostly unfelt.

Superior Oil would not have the opportunity to fully recover the investment it has in development of the proposed mineral recovery process. The technology can be used in other areas; however, its usefulness, or value, is greatest with the integrated project as proposed.

PRODUCT TRANSPORTATION

Construction of a railroad and pipeline would be an alternative means of hauling the production as shown in Table 1-1. The general alignment of these features is shown in Figure 8-1.

Railroad

Description of the Alternatives

The railroad would extend about 75 miles from the proposed plant site to about 17 miles south of Craig, Colorado, where a rail spur is presently under construction. This spur would serve the Colowyo mine as discussed in the Cumulative Impacts section of Chapter 6. It would take about 9,600 work months over a two year period to construct the railroad, beginning in approximately 1987. The rationale for waiting until 1987 to start construction is that Superior would want to be assured of markets, and its process, before investing the approximately $104 million cost.

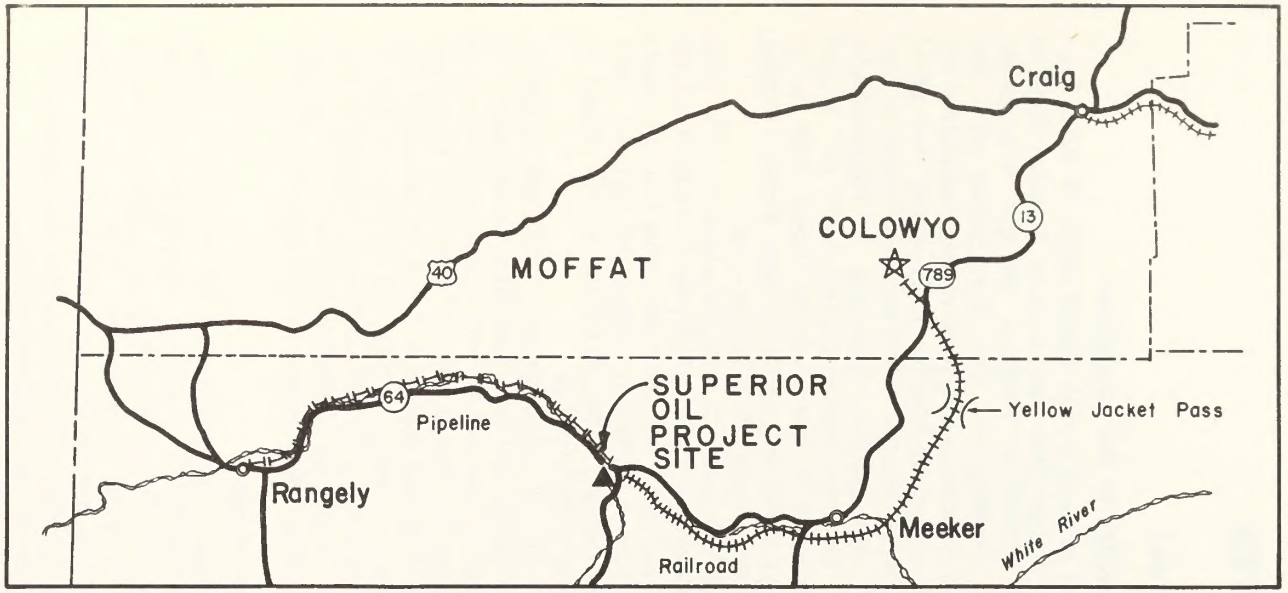
Approximately 25 acres, in addition to the acreage shown in Table 1-8, would be required at the proposed plant site for tracks and load-out facilities. The right-of-way along the railroad route would occupy about 930 acres, which would be essentially irretrievable.

To ship the approximately 5,200 tons of nahcolite, alumina, and soda ash daily would require an average of 1.0 train every 1.5 days, one-way, or an average of 1.3 trains per day round trip. Compared to trucking and piping, it is not economically reasonable to transport shale oil by rail because of such factors as the need for, and expense of, specially heated and insulated tank cars, cost of load-out facilities, and operation and maintenance costs.

Impact Analysis

During project operation, as proposed in Chapter 1 (Table 1-2), Superior's employment would be about 920. With the railroad, this figure would be reduced about 5 percent since about 50 truck drivers would not be required. This reduction would lessen the impact accordingly on the socioeconomic component and highway system.

Construction of the proposed Superior project would be complete in about 1986, at which time employment would drop from about 1,310 to 920. At the same time, railroad construction would begin. Peak employment associated with construction of the railroad would be about 400 people. These people would be "transient" requiring temporary housing and community services. The effect would be to extend for two more years the impacts



GENERAL ALIGNMENTS OF THE RAILROAD AND PIPELINE ALTERNATIVES

FIGURE 8-1

Skill Catagories	Average Number of Employees/Year 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994-2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Professional	12	30	62	65	68	70	72	114	125	125	125	159	159	155	155	159	159	136	125	98	79	-	-	-
Clerical	6	12	43	62	68	72	75	109	120	120	120	152	152	155	155	152	152	130	119	93	76	-	-	-
Technician	2	8	8	12	18	22	27	30	33	33	33	41	41	47	47	41	41	35	33	25	21	-	-	-
Operative	-	-	-	20	120	260	285	430	473	473	473	602	602	698	698	602	602	515	472	369	299	-	-	-
Mechanical	-	-	-	25	131	115	140	305	337	337	337	429	429	497	497	429	429	367	336	263	213	-	-	-
Railroad & Pipeline	-	-	-	-	-	-	-	182	400	233	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Construction	-	-	153	274	442	790	711	-	210	602	812	812	704	108	-	100	50	-	-	100	50	353	177	-
Total	20	50	268	458	847	1,329	1,310	1,186	1,698	1,923	1,900	2,195	2,087	1,660	1,552	1,483	1,433	1,183	1,085	948	738	353	177	0

Note:

Definitions: Professional - Administrative and scientific personnel

Clerical - Secretarial and other clerical positions

Technician - Skilled semi-professional people including draftsmen, and chemical laboratory technicians

Operative - Miners, plant operators, drivers, and guards

Mechanical - Building and maintenance tradesmen such as electricians, pipefitters, heavy equipment operators, and carpenters

Railroad & Pipeline - Construction skills required to develop these projects

Construction - Includes all the above skill categories

Employment remains constant throughout the operation of the project

EMPLOYMENT FOR THE EXPANDED RESOURCE ALTERNATE

TABLE 8-1

on the communities that would provide housing and services. The cost of providing community facilities and services would not be fully paid by those workers and the deficit would be made up by people living in the area.

Acreage occupied by the railroad would result in a loss of about 100 animal unit months (AUM). Because of the extent of the facility, no ranching operations would be significantly affected and the effect on wildlife and their habitat would be insignificant.

Truck haulage would be decreased by about 66 percent from about 670 truck trips per day (Table 1-4) to about 445. Increased highway maintenance cost, congestion, and safety hazards attributable to the truck traffic would be reduced proportionally.

Equivalent sound levels (L_{eq}) would be decreased by about 4.5 decibels (dba) on Piceance Creek Road. On other highway segments, the reduction would be about 1.0 dba. It takes about a 3.0 dba difference to be noticeable by humans. The trade-off would be that the noise emitted in new areas along the railroad alignment are presently serene when compared to the highway corridors. However, the number of affected people would be lower.

Projected traffic accidents (Table 6-21) would be reduced by about six per year. Each of the two grade crossings, shown in Figure 8-1, would have hazard ratings of about one accident every five years.

In addition to increased erosion and sedimentation, any cultural resources, historic or archaeologic, within the approximately 930-acre area would be impacted. A survey of the route would be carried out prior to disturbance, and the procedures mandated in Executive Order (EO) 11593 and other legislation would be carried out.

The approximately $104 million capital costs were amortized at 10 percent for 20 years to determine an average cost per ton to haul the products. Using this amortized rate only, the cost of hauling by rail would be about $6.50 per ton compared to about $3.50 with trucks. The figure for trucking includes amortization of equipment and operation and maintenance costs.

Pipeline

Description of the Alternative

To transport the approximately 11,500 barrels of shale oil that would be produced daily, an insulated pipeline, with a diameter of about 10 inches, would be constructed between the proposed plant site and Rangely, Colorado. In order to minimize surface disturbance, the alignment would parallel an existing pipeline right-of-way that has not been rehabilitated.

The approximately 35 miles of pipeline would require only one pump station due to the gradient, or relatively lower elevation of Rangely compared to the plant site. Electrical power to the pump would be supplied by a powerline off existing transmission facilities. Insulated pipe would be required because below about 90 degrees F, the shale oil would set up to a petroleum jelly-like consistency. Construction would take approximately 16 work months over a period of about one year, beginning in 1987, and would cost about $8 million.

Approximately 420 acres would be disturbed during construction of the pipeline. The acreage would be partially rehabilitated by practices including contouring and seeding.

Impact Analysis

Superior would not need to employ about 35 truck drivers during project operation. This is about 4 percent of the total 920 employees proposed (Table 1-2). The impacts described in Chapter 3 for the socioeconomic component and the highway system would be mitigated in the same apportion. The effect of the 16 employees needed to construct the facility would be insignificant.

About 35 AUMs would be lost by disturbance of the 420 acres along the pipeline alignment. Like the railroad, this quantity would not significantly affect the natural resources of the area or its people. The soil would be stabilized in about 15 years. Until then, erosion and sedimentation would occur.

Land disturbance would also affect cultural resources. A survey would be made and any sites located would be handled under the procedures mandated in EO 11593 and other statutes.

By piping the shale oil, about 170 truck trips per day to Rangely would be eliminated. As with the railroad, highway maintenance cost would decrease and the equivalent sound level (L_{eq}) would be reduced by about 2 dba between the proposed plant site and Rangely. Projected accidents (Table 6-21) would be reduced by about seven per year. The cost of piping the oil would be essentially the same as trucking.

EXPANDED RESOURCE DEVELOPMENT ALTERNATIVE

Description of the Proposal

This section analyzes the impact of leasing federal land, in lieu of a land exchange, for an expanded development using the technology Superior has developed and proposed as described in Chapter 1.

Leasing

The Secretary of the Interior has statutory authority to grant oil shale leases. Since only Superi-

TABLE 8-1

or controls its particular technology, the lease would be noncompetitive. Leasing authority is contained in the Mineral Leasing Act of 1920 (41 Stat. 437) as amended (30 USC ss181-263). The lease would be subject to the terms, conditions, and requirements of pertinent regulations in effect at the time of the lease (30 CFR 231, 43 CFR 23, and 43 CFR Group 3000).

The leasing program would be carried out similar to the prototype program of which Ca and Cb are a part, as discussed in Chapter 6--Cumulative Impacts. As established in Secretarial Order 2948, the program would be implemented through the cooperative efforts of BLM and U.S. Geological Survey.

The Secretary of the Interior has the latitude to establish minimum lease royalties in order to maximize mineral recovery, and to encourage establishment of a commercial oil shale industry. Decision factors for the Secretary include demonstrated lease-performance capability and projected economic conditions for marketing the products. The Secretary can lease up to 5,120 acres. A lease of about 5,000 acres is described and analyzed in this chapter in order to present the maximum range of impacts. This 5,000 acres makes the alternative a logical mining unit.

Project Development

The precise configuration of a 5,000-acre lease tract would be determined following detailed investigations. Criteria for selecting a mining area would include locating within the zones of significant nahcolite and dawsonite deposits (Figure 2-1) and locating adjacent to the lower leg of the L-shaped parcel Superior presently owns (Map 1-2). By locating adjacent to Superior's property the company would be able to economically mine about 800 acres of Superior's land. Regardless of the final configuration, surface features would remain identical, as would the other components, and therefore not affect significantly different impacts.

In planning this alternative, the known geology data from core holes drilled by Superior were extrapolated and the project features, their capacities, and resource requirements were factored, based on the information supplied by Superior for the proposal in Chapter 1. Working sheets used in these projections are available upon request to BLM.

Major premises for the alternative include: 1) An average of 17 percent nahcolite content oil shale would be required in order to reduce the volume of processed shale sufficiently to be backfilled into the mine; 2) To help make the alternative economical, the average content of alumina and shale oil must be 3 percent and 21 gallons per ton, respectively; 3) Overall mineral recovery would be about 55 percent; and 4) Due to the economics of sizing and engineering and technological limits, the maximum capacity of one oil recovery unit, or retort, would be approximately 20,000 tons per day.

The mine and its auxiliary facilities would be constructed and operated essentially in the same fashion as described in Chapter 1. The plant would be constructed in stages and in modules.

Chapter 1--Description of the Proposed Action--describes all initial activities associated with this alternative up to about 1987. Features shown in Table 2-1 would also apply. This development would represent the first module. Two years later, about 1989, construction of the second module would occur. During these interim two years, the facilities would be monitored, including air emissions. Based on the results of the data collected, the engineering for the second module would be refined.

If the air emission data collected from the first module reveals that pollution standards would not be met with a second or third module, then further construction would not take place. A second or third module might not be constructed for other reasons too, including existing market conditions for products or other economic or technological difficulties. With only one module and the mineral resources available under the lease, the unit would continue to produce for over 100 years. Those impacts described in Chapter 3 would then apply except for duration, which would tend to mitigate adverse impacts.

Construction of the second module would take place between 1989 and 1991, while the third module would be built between 1991 and 1993. The railroad and pipeline described in the Product Transportation alternative would be used to haul products.

Impact Analysis

The same assumptions and methods were used in this section as were used in Chapter 3. Primary differences in impacts between Chapter 3 and this chapter are in terms of magnitude and duration. These "differences" are summarized below and the impact analyses for each resource component in Chapter 3 should be referred to. A complete summary of resource requirement of the alternative is included in the available working papers mentioned before.

Socioeconomics

Projected employment is shown in Table 8-1. Incomes and populations, distributed throughout Garfield and Rio Blanco Counties, are shown in Tables 8-2 and 8-3, respectively. The population has been distributed as follows: 34 percent in Gar-

Year	Garfield County		Rio Blanco County		
	Total County	Rifle Only	Total County	Rangely Only	Meeker Only
1980	117,315	84,779	417,017	84,779	299,702
1981	335,241	236,814	1,025,703	184,025	756,080
1982	1,705,257	1,150,266	5,254,968	988,240	4,038,760
1983	2,879,609	1,915,463	8,925,690	1,648,306	6,860,381
1984	6,600,911	4,398,564	16,809,593	3,114,086	11,896,549
1985	10,290,235	6,870,826	26,359,570	4,852,000	20,278,566
1986	10,131,990	6,739,813	25,896,447	4,773,520	19,956,358
1987	14,155,141	12,728,983	18,124,939	8,143,344	9,952,130
1988	21,356,224	19,199,548	27,555,432	12,402,642	15,152,790
1989	24,415,624	21,963,802	31,566,733	14,193,762	17,354,649
1990	24,121,279	21,688,449	31,195,300	14,033,307	17,143,681
1991	26,734,190	24,067,456	34,515,455	15,521,792	18,975,656
1992	26,129,328	23,518,961	33,706,808	15,154,484	18,539,495
1993	19,895,048	17,894,730	25,406,292	11,413,211	13,963,961
1994-2023	18,256,135	16,419,556	23,214,917	10,441,363	12,760,723
2024	17,822,340	16,046,164	22,777,596	10,250,168	12,514,599
2025	17,132,178	15,410,319	21,877,121	9,834,331	12,026,570
2026	14,065,653	12,648,185	17,926,415	8,055,663	9,854,719
2027	12,889,464	11,600,197	16,446,033	7,389,169	9,044,035
2028	11,454,207	10,315,580	14,676,342	6,596,233	8,063,488
2029	8,859,889	7,971,905	11,320,535	5,086,936	6,220,770
2030	4,835,098	4,360,565	6,378,026	2,859,852	3,496,804
2031	2,452,553	2,217,207	3,261,666	1,451,448	1,788,099

TOTAL ANNUAL INCOME OF SUPERIOR OIL AND NON-BASIC EMPLOYEES BY RESIDENCE, EXPANDED RESOURCE ALTERNATE (1977 DOLLARS)

TABLE 8-2

Year	New Rifle Population				New Rangely Population				New Meeker Population			
	Trended Pop.	Basic Employ.	Non-Basic Employ.	Total New Pop.	Trended Pop.	Basic Employ.	Non-Basic Employ.	Total New Pop.	Trended Pop.	Basic Employ.	Non-Basic Employ.	Total New Pop.
1980	2,633	6	6	2,644	1,974	5	5	1,984	1,947	20	20	1,987
1981	2,745	14	14	2,773	2,004	12	12	2,028	1,976	50	50	2,076
1982	2,858	75	74	3,007	2,033	66	65	2,164	2,005	265	262	2,532
1983	2,971	129	127	3,227	2,062	114	113	2,289	2,034	457	450	2,941
1984	3,084	238	412	3,734	2,091	211	234	2,536	2,064	845	938	3,846
1985	3,197	371	642	4,210	2,121	329	365	2,815	2,092	1,316	1,462	4,870
1986	3,370	368	618	4,356	2,498	315	340	3,154	2,464	1,319	1,424	5,208
1987	3,504	740	1,364	5,608	2,598	581	627	3,807	2,562	710	767	4,040
1988	3,644	1,074	1,805	6,524	2,702	845	912	4,459	2,665	1,032	1,115	4,812
1989	3,790	1,217	2,047	7,054	2,810	955	1,033	4,799	2,771	1,168	1,262	5,202
1990	3,942	1,203	2,020	7,166	2,922	945	1,021	4,888	2,882	1,154	1,248	5,285
1991	4,100	1,346	2,262	7,708	3,039	1,056	1,142	5,237	2,997	1,291	1,395	5,684
1992	4,264	1,321	2,221	7,807	3,160	1,038	1,120	5,318	3,117	1,269	1,371	5,757
1993	4,434	1,050	1,767	7,251	3,287	824	890	5,002	3,242	1,010	1,088	5,340
1994	4,611	981	1,651	7,244	3,418	772	832	5,023	3,372	943	1,018	5,334
1995	4,796	981	1,651	7,428	3,555	772	832	5,160	3,506	943	1,018	5,467
2000	5,835	981	1,651	8,467	4,325	772	832	5,929	4,266	943	1,018	6,227
2010	8,637	981	1,651	11,269	6,402	772	832	8,006	6,315	943	1,018	8,276
2020	12,785	981	1,651	15,417	9,477	772	832	11,081	9,348	943	1,018	11,309
2025	15,555	907	1,523	17,986	11,530	712	770	13,012	11,373	901	973	13,247
2026	16,177	748	1,257	18,183	11,992	587	634	13,214	11,828	871	946	13,645
2027	16,824	686	1,154	18,664	12,471	539	581	13,592	12,301	718	777	13,796
2028	17,497	600	1,009	19,105	12,970	470	509	13,950	12,793	659	712	14,165
2029	18,197	466	784	20,168	13,489	366	395	14,251	13,305	575	622	14,503
2030	18,925	223	374	19,522	14,029	175	188	14,392	13,837	448	482	14,768
2031	19,682	110	188	19,980	14,590	86	94	14,770	14,390	213	231	14,835

PROJECTED NEW POPULATIONS FOR RIFLE, RANGELY, AND MEEKER WITH THE PROPOSED SUPERIOR OIL PROJECT EXPANDED RESOURCE ALTERNATE

TABLE 8-3

field County; 56 percent in Rio Blanco County; and 10 percent in Mesa County. Maximum increases in population would be about 20 percent over trended population as analyzed in Chapter 3, but would be about 80 percent with this alternative.

New jobs, higher wages, and the influx of new people would create high demands for goods and services, resulting in an inflated economy. The overall standards of living would increase; however, those on fixed incomes would be forced into a lower level of living standard or be forced to leave the area.

The new population would require expanded community services. Cost/revenue analyses were made to determine the effects of maintaining the current level of services. Results of the analyses are shown in Tables 8-4 through 8-11. Initially, Garfield and Rio Blanco Counties would have sufficient revenue (Table 8-4). However, after about 1986 in Garfield County and 1987 in Rio Blanco County, the counties would not have sufficient revenues, nor would the the three communities of Rifle, Meeker, and Rangely, or the Rifle and Meeker School Districts. Either the service levels would decrease, or taxes increase, within these jurisdictions. These actions would lower the quality of life within the area. The Meeker School District would have sufficient revenue to cover costs (Table 8-11). Service levels and facilities would be expanded.

The trend away from an agricultural-type lifestyle to an industrial-type lifestyle would occur as would the effects described in Chapter 3. Effects on the "valued" elements of the physical environment, including clean air and quietness, would have longer durations.

Land Use

With the alternative, the L-shaped mineral holdings of Superior (Map 1-2) would not be affected. These holdings would continue to segregate adjacent publicly-owned surface and minerals and reduce the potential for future development.

The two ranches that would be significantly impacted by the land exchange would not be involved with the alternative. Livestock access to Piceance Creek would remain and there would not be significant forage losses.

Highway System

Even though production would increase (Table 8-12), most truck traffic associated with haulage of the product would be eliminated by the railroad and pipeline. Higher peak-hour traffic would occur, however, because of increased employment (Table 8-13). No lowering of the service level would occur and maintenance costs would be significantly lower since the heavily loaded trucks, as described in Chapter 3, would be the major cause of damage, not the passenger vehicles.

Climate and Air Quality

Predicted operational emission rates would not exceed those used in calculations discussed in Chapter 3. The one exception is total suspended particulate (TSP). Sulfur dioxide emissions in this alternative would be reduced by using nahcolite as a scrubber on the steam plants, along with baghouses for particulate control.

Since the emission rates are the same, or less, for every category except TSP, modeled results from Chapter 3 would also represent the alternative. The maximum TSP increment would be about 66 $\mu g/m^3$. Added to the 24-hour baseline of 11 $\mu g/m^3$ (Table 2-13), the total concentration would be about 77 $\mu g/m^3$. This value does not exceed the federal standard of 260 or the state's 150. However, the 66 $\mu g/m^3$ does exceed the Class II allowable increment of 37 $\mu g/m^3$.

Annual salt deposition from the cooling tower would be about 750 pounds per acre, compared to 250 pounds per acre as proposed in Chapter 3. This new rate was used in calculating the effects discussed in the water resources section.

Water Resources

With the water usage of the project and new populations in Meeker and Rangely, the average annual flow in the White River below Rangely would decrease by about 1,925 acre feet annually. An annual average of approximately 94,000 tons of salt would be removed. The result of the salt removal would be a decrease in salinity in the Colorado River of about 8 milligrams per liter (mg/l). The decrease in Chapter 3 is about 2 mg/l. At a value of $230,000 per milligram, the average annual public benefit over the life of the alternative would be about $1.8 million.

Year	Costs ($)			Revenue ($)		
	Capital	O & M	Total	Property	Other	Total
1980	2,172	228	1,560	627	1,368	1,995
1981	5,068	532	3,640	1,463	3,192	4,655
1982	26,969	2,831	19,370	7,785	16,986	24,771
1983	46,336	4,864	33,280	13,375	29,184	42,559
1984	117,650	12,350	84,500	33,960	74,100	108,060
1985	183,353	19,247	131,690	52,925	115,482	168,407
1986	178,466	18,734	197,200	51,515	112,404	163,919
1987	380,824	39,976	420,800	109,926	239,856	349,782
1988	521,099	54,701	575,800	150,417	328,206	478,623
1989	590,784	62,016	652,800	170,532	372,096	542,628
1990	583,363	61,237	644,600	168,390	367,422	535,812
1991	653,048	68,552	721,600	188,504	411,312	599,816
1992	641,102	67,298	708,400	185,056	403,788	588,844
1993	509,877	53,523	563,400	147,178	321,138	468,316
1994-2020	476,392	50,008	526,400	137,512	300,048	437,560
2025	439,830	46,170	486,000	126,958	277,020	403,978
2026	362,905	38,095	401,000	104,754	228,570	333,324
2027	333,040	34,960	368,000	96,133	209,760	305,893
2028	291,229	30,571	321,800	84,064	183,426	267,490
2029	226,250	23,750	250,000	65,308	142,500	207,808
2030	109,057	11,343	119,400	31,191	68,058	99,249
2031	53,938	5,662	59,600	15,569	33,972	49,541

Note:

Total figures for 1980-1985 were adjusted for impermanency of impact population.

COSTS AND REVENUE ANALYSIS FOR GARFIELD COUNTY WITH THE EXPANDED RESOURCE ALTERNATIVE (CONSTANT 1977 DOLLARS)

TABLE 8-4

Year	Costs ($)			Revenue ($)		
	Capital	O & M	Total	Property	Other	Total
1980	9,050	950	6,500	861	5,700	6,561
1981	22,444	2,356	16,120	6,570	14,136	20,706
1982	119,098	12,502	85,540	49,061	75,012	124,073
1983	205,254	21,546	147,420	97,718	129,275	226,994
1984	403,268	42,332	289,640	116,706	253,992	370,698
1985	628,432	65,968	451,360	126,853	395,808	522,661
1986	615,038	64,562	679,600	109,850	387,372	497,222
1987	485,985	51,015	537,000	80,638	306,090	386,728
1988	706,624	74,176	780,800	68,794	445,056	513,850
1989	799,658	83,942	883,600	112,943	503,652	616,595
1990	790,608	82,992	873,600	130,289	497,952	628,241
1991	884,004	92,796	976,800	138,091	556,776	694,867
1992	868,438	91,162	959,600	141,110	546,972	688,082
1993	689,972	72,428	762,400	142,802	434,568	577,370
1994-2020	645,265	67,735	713,000	142,802	406,410	549,212
2025	607,436	63,764	671,200	142,316	382,584	524,900
2026	549,878	57,722	607,600	142,316	346,332	488,648
2027	473,315	49,685	523,000	142,316	298,110	440,426
2028	425,350	44,650	470,000	141,596	267,900	409,496
2029	354,398	37,202	391,600	141,050	223,212	364,262
2030	234,033	24,567	258,600	141,050	147,402	288,452
2031	112,944	11,856	124,800	141,050	71,136	212,186

Note:

Figures for 1980-1985 were adjusted for impermanency of impact population.

COSTS AND REVENUE ANALYSIS FOR RIO BLANCO COUNTY WITH THE EXPANDED RESOURCE ALTERNATIVE (CONSTANT 1977 DOLLARS)

TABLE 8-5

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	10,400	1,120	11,520	1,964	783	3,280	6,027
1981	26,000	2,800	28,800	491	1,975	820	3,286
1982	137,020	14,756	151,776	25,877	10,552	43,214	79,643
1983	235,820	25,396	261,216	44,535	17,923	74,374	136,832
1984	463,580	49,924	513,504	87,548	31,081	146,206	264,835
1985	722,280	77,784	800,064	136,222	52,980	227,796	416,998
1986	713,180	76,804	789,984	134,686	52,138	224,926	411,750
1987	384,020	41,356	425,376	72,523	26,001	121,114	219,638
1988	558,220	60,116	618,336	105,421	39,588	176,054	321,063
1989	631,800	68,040	699,840	119,317	45,341	199,260	363,918
1990	624,520	67,256	691,776	117,942	44,790	196,964	359,696
1991	698,360	75,208	773,568	131,887	49,576	220,252	401,715
1992	686,400	73,920	760,320	129,628	48,436	216,480	394,544
1993	545,480	58,744	604,224	103,015	36,482	172,036	311,533
1994-2020	509,860	54,908	564,768	96,288	33,339	160,802	290,429
2025	487,240	52,472	539,712	92,016	31,421	153,668	277,105
2026	472,420	50,876	523,296	89,217	25,747	148,994	263,958
2027	388,700	41,860	430,560	73,407	23,629	122,590	219,626
2028	356,460	38,388	394,848	67,318	21,067	112,422	200,807
2029	311,220	33,516	344,736	58,775	16,252	98,154	173,181
2030	241,800	26,040	267,840	45,664	9,136	76,260	131,060
2031	115,440	12,432	127,872	21,801	4,672	36,408	62,881

COSTS AND REVENUE ANALYSIS FOR RIFLE WITH THE EXPANDED RESOURCE ALTERNATIVE
(CONSTANT 1977 DOLLARS)

TABLE 8-6

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	2,600	280	1,872	976	155	950	2,081
1981	6,240	672	4,493	246	437	2,280	2,963
1982	34,060	3,668	24,523	12,781	2,347	12,445	27,573
1983	59,020	6,356	42,494	22,147	3,914	21,565	47,626
1984	115,700	12,460	83,304	23,903	7,395	23,275	54,573
1985	180,440	19,432	129,917	67,710	11,522	65,930	145,162
1986	170,300	18,340	188,640	63,905	11,336	62,225	137,466
1987	314,080	33,824	347,904	117,859	19,338	114,760	251,957
1988	456,820	49,196	506,016	171,422	29,452	166,915	367,789
1989	516,880	55,664	572,544	193,959	33,706	188,860	416,525
1990	511,160	55,048	566,208	191,813	33,325	186,770	411,908
1991	571,480	61,544	633,024	21,445	36,859	208,810	267,114
1992	561,080	60,424	621,504	210,545	35,987	205,010	451,542
1993	445,640	47,992	493,632	167,226	27,103	162,830	357,159
1994-2020	417,040	44,912	461,952	156,494	24,795	152,380	333,669
2025	385,320	41,496	426,816	144,591	23,353	140,790	308,734
2026	317,460	34,188	351,648	119,127	19,130	115,995	254,252
2027	291,200	31,360	322,560	109,273	17,547	106,400	233,210
2028	254,540	27,412	281,952	95,516	15,664	93,005	204,185
2029	197,860	21,308	219,168	74,247	12,080	72,295	158,622
2030	94,380	10,164	104,544	35,416	6,791	34,485	76,692
2031	46,800	5,040	51,840	17,562	3,447	17,100	38,109

COSTS AND REVENUE ANALYSIS FOR RANGELY WITH THE EXPANDED RESOURCE ALTERNATIVE
(CONSTANT 1977 DOLLARS)

TABLE 8-7

Year	Costs ($) Capital	O & M	Total	Revenues ($) Property	Sales	Other	Total
1980	3,120	336	2,246	612	443	816	1,871
1981	7,280	784	5,242	1,428	1,237	1,904	4,569
1982	38,740	4,172	27,893	7,599	6,010	10,132	23,741
1983	66,560	7,168	47,923	13,056	10,009	17,408	40,473
1984	169,000	18,200	121,680	33,150	22,983	44,200	100,333
1985	263,380	28,364	189,634	51,663	35,902	68,884	156,449
1986	256,360	27,608	283,968	50,286	35,217	67,048	152,551
1987	547,040	58,912	605,952	107,304	66,512	143,072	316,888
1988	748,540	80,612	829,152	146,829	100,322	195,772	442,923
1989	848,640	91,392	940,032	166,464	114,766	221,952	503,182
1990	837,980	90,244	928,224	164,373	113,327	219,164	496,864
1991	938,080	101,024	1,039,104	184,008	125,758	245,344	555,110
1992	920,920	99,176	1,020,096	180,642	122,892	240,856	544,390
1993	732,420	78,876	811,296	143,667	93,504	191,556	428,727
1994-2020	684,320	73,696	758,016	134,232	85,796	178,976	399,004
2025	631,800	68,040	699,840	123,930	80,522	165,240	369,692
2026	521,300	56,140	577,440	102,255	66,090	136,340	304,685
2027	478,400	51,520	529,920	93,840	60,614	125,120	279,574
2028	418,340	45,052	463,392	82,059	53,901	109,412	245,372
2029	325,000	35,000	360,000	63,750	41,655	85,000	190,405
2030	155,220	16,716	171,936	30,447	22,785	40,596	93,828
2031	77,480	8,344	85,824	15,198	11,402	20,264	46,864

COSTS AND REVENUE ANALYSIS FOR MEEKER WITH THE EXPANDED RESOURCE ALTERNATIVE
(CONSTANT 1977 DOLLARS)

TABLE 8-8

Year	Costs ($)		Revenues ($)	
	O & M	Total	Property	Total
1980	4,284	4,284	2,256	2,256
1981	9,996	9,996	5,264	5,264
1982	53,193	53,193	28,012	28,012
1983	91,392	91,392	48,128	48,128
1984	232,050	232,050	122,200	122,200
1985	361,641	361,641	190,444	190,444
1986	352,002	352,002	185,368	185,368
1987	751,128	751,128	395,552	395,552
1988	1,027,803	1,027,803	541,252	541,252
1989	1,165,248	1,165,248	613,632	613,632
1990	1,150,611	1,150,611	605,924	605,924
1991	1,288,056	1,288,056	678,304	678,304
1992	1,264,494	1,264,494	665,896	665,896
1993	1,005,669	1,005,669	529,596	529,596
1994-2020	939,624	939,624	494,816	494,816
2025	867,510	867,510	456,840	456,840
2026	715,785	715,785	376,940	376,940
2027	656,880	656,880	345,920	345,920
2028	574,413	574,413	302,492	302,492
2029	446,250	446,250	235,000	235,000
2030	213,129	213,129	112,236	112,236
2031	106,386	106,386	56,024	56,024

COST AND REVENUE ANALYSIS FOR RIFLE SCHOOL DISTRICT (RE-2)
WITH THE EXPANDED RESOURCE ALTERNATIVE

TABLE 8-9

Year	Costs ($)		Revenues ($)	
	O & M	Total	Property	Total
1980	2,890	2,890	198	198
1981	6,936	6,936	475	475
1982	37,859	37,859	2,594	2,594
1983	65,603	65,603	4,495	4,495
1984	128,605	128,605	8,811	8,811
1985	200,566	200,566	13,741	13,741
1986	189,295	189,295	12,969	12,969
1987	349,112	349,112	23,918	23,918
1988	597,773	597,773	34,789	34,789
1989	574,532	574,532	39,362	39,362
1990	568,174	568,174	38,927	38,927
1991	635,222	635,222	43,520	43,520
1992	623,662	623,662	42,728	42,728
1993	495,346	495,346	33,937	33,937
1994-2020	463,556	463,556	31,759	31,759
2025	428,298	428,298	29,344	29,344
2026	352,809	352,809	24,176	24,176
2027	323,680	323,680	22,176	22,176
2028	282,931	282,931	19,384	19,384
2029	219,929	219,929	15,068	15,068
2030	104,907	104,907	7,187	7,187
2031	52,020	52,020	3,564	3,564

COST AND REVENUE ANALYSIS FOR RANGELY SCHOOL DISTRICT (RE-4)
WITH THE EXPANDED RESOURCE ALTERNATIVE

TABLE 8-10

Year	Costs ($)		Revenues ($)	
	O & M	Total	Property	Total
1980	11,560	11,560	6,314	6,314
1981	28,900	28,900	48,186	48,186
1982	152,303	152,303	359,783	359,783
1983	262,123	262,123	716,602	716,602
1984	515,287	515,287	855,850	855,850
1985	802,842	802,842	930,263	930,263
1986	792,727	792,727	805,573	805,573
1987	426,853	426,853	591,349	591,349
1988	620,483	620,483	504,494	504,494
1989	702,270	702,270	828,251	828,251
1990	694,178	694,178	955,457	955,457
1991	776,254	776,254	1,012,668	1,012,668
1992	762,960	762,960	1,034,809	1,034,809
1993	606,322	606,322	1,047,221	1,047,221
1994-2020	566,729	566,729	1,047,221	1,047,221
2025	541,586	541,586	1,043,657	1,043,657
2026	525,113	525,113	1,043,657	1,043,657
2027	432,055	432,055	1,038,371	1,038,371
2028	396,219	396,219	1,038,371	1,038,371
2029	345,933	345,933	1,038,917	1,038,917
2030	268,770	268,770	1,038,917	1,038,917
2031	128,316	128,316	1,038,917	1,038,917

COST AND REVENUE ANALYSIS FOR MEEKER SCHOOL DISTRICT (RE-1)
WITH THE EXPANDED RESOURCE ALTERNATIVE

TABLE 8-11

Daily Production	1987	1988	1989	1990	1991	1992	1993	1994-2023	2024-2025	2026	2027	2028	2029
Mine (T/D)	26,800	40,000	40,000	40,000	70,000	70,000	70,000	70,000	70,000	40,000	26,800	-	-
Nahcolite (T/D)	4,878	4,878	4,878	6,097	7,317	8,537	9,756	9,756	9,756	9,756	9,756	4,878	2,439
Shale Oil (8BL/D)	11,884	11,884	11,884	11,884	23,768	23,768	35,652	35,652	23,768	23,768	23,768	11,884	11,884
Alumina (T/D)	630	630	630	630	1,260	1,260	1,992	1,992	1,260	1,260	1,260	630	630
Soda Ash (T/D)	1,227	1,227	1,227	1,227	1,997	3,993	4,763	6,954	4,763	4,763	4,763	1,227	1,227

Note:

T/D = Tons per day

8BL/D = Barrels per day

MINING AND PRODUCTION SCHEDULES FOR THE EXPANDED RESOURCE DEVELOPMENT ALTERNATIVE

TABLE 8-12

	Road Segment													
	A		B_1		B_2		C		D		E		F	
Year	Ave Peak	Max Peak	Ave Peak	Max Peak	Ave Peak	Max Peak	Ave Peak	Max Peak	Ave Peak	Max Peak	Ave Peak	Max Peak	Ave Peak	Max Peak
							Peak Hour Traffic							
1990	452	516	202	225	198	218	291	420	82	162	329	375	271	310
1995	273	343	111	136	106	129	207	347	86	170	172	220	142	182
2000	281	355	116	143	111	136	233	363	90	178	174	225	144	187
2005	293	373	120	150	115	143	227	387	94	186	177	230	146	190
2010	301	385	124	157	120	150	235	403	98	194	180	234	149	195
2015	317	409	129	164	125	157	243	419	106	210	172	220	164	221
2020	333	433	134	171	129	164	251	435	112	223	176	227	167	228
2025	334	444	130	170	126	163	251	445	120	237	148	203	177	240
2030	376	494	146	189	142	182	272	473	136	251	166	221	201	226
							Volume to Capacity Percentages							
1990	.41	.47	.41	.45	.40	.44	.27	.38	.07	.15	.40	.46	.33	.38
1995	.25	.31	.22	.27	.21	.26	.18	.32	.08	.15	.21	.27	.17	.22
2000	.25	.32	.23	.29	.22	.27	.21	.33	.11	.22	.21	.27	.17	.27
2005	.27	.34	.24	.30	.23	.29	.21	.35	.09	.17	.22	.28	.18	.23
2010	.27	.35	.25	.31	.24	.30	.21	.37	.09	.18	.22	.29	.18	.24
2015	.29	.37	.26	.33	.25	.31	.22	.38	.10	.19	.21	.27	.20	.27
2020	.30	.39	.27	.34	.26	.33	.23	.40	.10	.20	.21	.28	.20	.27
2025	.30	.40	.26	.34	.25	.33	.23	.40	.18	.22	.18	.25	.22	.29
2030	.34	.45	.29	.38	.28	.36	.25	.43	.12	.23	.20	.27	.24	.32

Note: 1980 and 1985 will remain the same as Table 3-25.

PEAK HOUR TRAFFIC AND VOLUME TO CAPACITY PERCENTAGES BY ROAD SEGMENT AND YEAR

TABLE 8-13

CHAPTER 9

CONSULTATION AND COORDINATION

CONSULTATION AND COORDINATION DURING PREPARATION OF THE ENVIRONMENTAL STATEMENT

During preparation of this draft environmental statement (DES), several agencies reviewed preliminary drafts and provided comments. These agencies included the U.S. Fish and Wildlife Service, U.S. Geological Survey (USGS), Environmental Protection Agency (EPA), and Colorado Division of Wildlife. Local officials in the area, including the planning organizations, that would be affected were contacted during the impact assessment process. For the most part, the results of these contacts are cited in the previous chapters.

The State Highway Department assisted in the development of the methodology used to assess potential impacts on the highway system. USGS, EPA, and the State Health Departments provided consultation regarding air emissions and other air quality aspects of the proposed project.

Agencies and others that have requested copies of the DES, or have been requested to comment, include the following.

Federal

- Department of Agriculture
  - Agricultural Research Service
  - Forest Service
  - Soil Conservation Service
- Department of Commerce
- Department of Energy
- Department of Health, Education, and Welfare
- Department of Housing and Urban Development
- Department of the Interior
  - Bureau of Mines
  - Bureau of Reclamation
  - Fish and Wildlife Service
  - Geological Survey
  - Heritage Conservation and Recreation Service
  - National Park Service
  - Office of Surface Mining
- Department of the Navy
- Department of Transportation
  - Federal Highway Administration
- Environmental Protection Agency
- General Services Administration
- Advisory Council on Historic Preservation
- Army Corps of Engineers
- General Accounting Office
- Interstate Commerce Commission
- Mine Safety and Health Administration
- Office of Economic Opportunity
- Office of Management and Budget
- Occupational Safety and Health Administration
- Rural Electrification Administration

Colorado State Agencies

- Office of the Governor
- Colorado Division of Planning--State Clearing House (distributes to state agencies)

Local Governments

- Colorado Communities
  - Craig
  - DeBeque
  - Dinosaur
  - Glenwood Springs
  - Grand Junction
  - Hayden
  - Meeker
  - Oak Creek
  - Rangely
  - Rifle
  - Yampa
- County Commissions
  - Garfield County
  - Mesa County
  - Moffat County
  - Rio Blanco County
  - Routt County

Associations

- American Camping Association
- American Canoe Association
- American Institute of Mining Engineers
- American Mining Congress
- American Sportsmen's Club
- Audubon Society
- Club 20
- Colorado Bar Association
- Colorado Association of County Commissioners
- Colorado Association of Commerce and Industry
- Colorado Cattlemen's Association
- Colorado Dude and Guest Ranch Association
- Colorado Environmental Health Association
- Colorado Farm Bureau
- Colorado Federation of Women's Club
- Colorado Federation of Garden Clubs
- Colorado Four-Wheel Drive Association
- Colorado Guides and Outfitters Association
- Colorado Mining Association
- Colorado Motorcycle Association
- Colorado Mountain Club
- Colorado Open Space Council
- Colorado Parks and Recreation Society
- Colorado Petroleum Association
- Colorado Ridgerunners

Colorado Rivers Council
Colorado Sportsmen's Association
Colorado Water Congress
Colorado White Water Association
Colorado Wildlife Association
Colorado Wildlife Federation
Colorado Wildlife Society
Colorado Woolgrowers Association
Conservation Foundation
Defenders of Wildlife
Environmental Action of Colorado
Environmental Defenders, Inc.
Environmental Defense Fund
Environmental Policy Center
Friends of the Earth
Grand Mesa Jeep Club
Great Divide Four Wheelers
Independent Petroleum Association of America
International Society for the Protection of Mustangs and Burros
Izaak Walton League of America
Keep Colorado Beautiful, Inc.
League of Women Voters of Colorado
MARMOT
Metro Wildlife Association
Mile Hi Snowmobile Club
Motorized Recreation Association
Mountain State Legal Foundation
National Association of Conservation Districts
National Cattlemen's Association
National Council of Public Land Users
National Environmental Health Association
National Parks and Conservation Association
National Resources Defense Council, Inc.
National Wildlife Federation
Nature Conservancy
Protect Our Mountain Environment, Inc.
Public Lands Council
Public Lands Institute
PURE
Recreational Use of Public Land
Rio Blanco Historical Society
Rocky Mountain Association of Geologists
Rocky Mountain Center on Environment
Rocky Mountain Federation of Mineralogical Societies
Rocky Mountain Motorcycles
Rocky Mountain Oil and Gas Association
Rocky Mountain Sportsmen Federation
Rocky Mountain Succulent Society
Routt-Moffat Woolgrowers Association
Roundup Riders of the Rockies
Sierra Club
Society for Range Management
Snowtrac Snowmobile Club
Trout Unlimited
United Mine Workers
United Sportsman's Club
West Slope Environmental Coordinating Center
Western Governors
Wilderness Society
Wilderness Study Group
Wildlife Society
Yampa Valley Environmental Action Group

Individuals

Robert Accola
Sherman Brady
Kay Collins
John Hart
Clifford Henry
John Hutchins
Steve Rudy
Don Sherwood
Floyd Stevenson

Firms

Carter Mining Company
Energy and Environmental Analysis
Energy Research Institute
Enviro-Geo-Chemical Services
Harrison Western Corporation
Lawrence Livermore Laboratory
Petroleum Information Corporation
Superior Oil Company
Texas Oil and Gas Corporation
Thorne Ecological Institute
Union Research Center
Western Slope Energy Research Company

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Company land e

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Proposed Superior Oil Company L
Oil Shale Development Environm

Map 1-2

Scale = Feet

1000 2000 3000 4000

Contour Interval 100 Feet
Datum is mean sea level

-LEGEND-

- HEAVY DUTY ROAD
- MEDIUM DUTY ROAD
- UNIMPROVED DIRT ROAD
- TRAIL
- PIPELINE
- POWERLINE
- BRIDGE
- BUILDING
- (64) STATE ROUTE

United States
Department of the Interior
Bureau of Land Management
Colorado State Office
Denver, Colorado

N

WHITE RIVER

COLORADO DIVISION OF WILDLIFE

Gravel Pits

Gas Well

DETAIL "A"

(EXCEPTED)

White Ri
(Site)

Creek

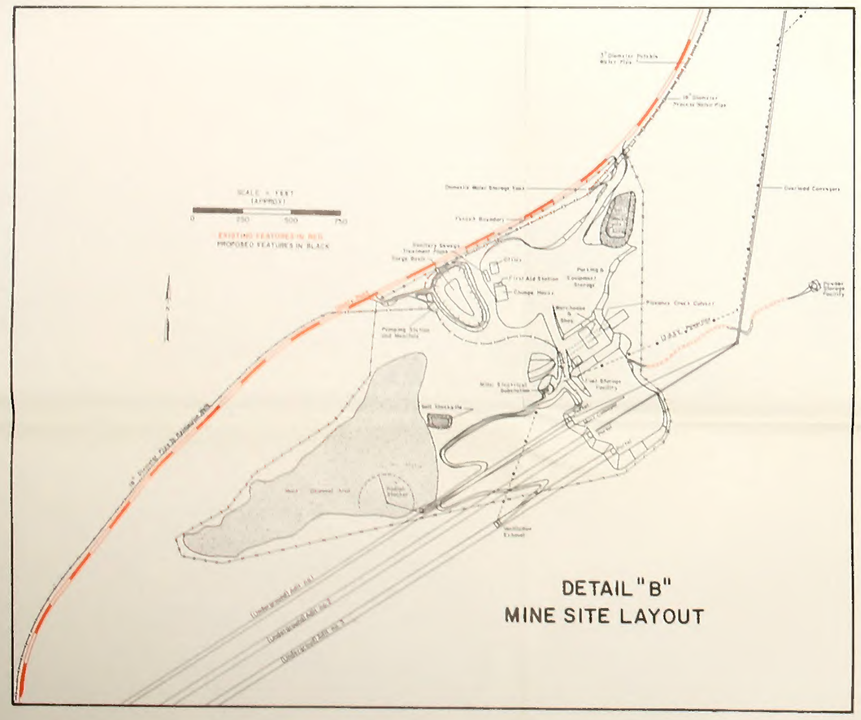
TRAIL

JEEP TRAIL

PIPELINE

Yellow

30 29 28 31 32 33 6 5 4 3 2 1 7 8 9 10 11



DETAIL "B"
MINE SITE LAYOUT

Proposed Superior Oil Company Land Exchange & Oil Shale Development Environmental Statement

Map 1-2

Scale = Feet

1000 2000 3000 4000 5000

Contour Interval 100 Feet
Datum is mean sea level

United States
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Colorado State Office
Denver, Colorado

-LEGEND-

- HEAVY DUTY ROAD
- MEDIUM DUTY ROAD
- UNIMPROVED DIRT ROAD
- TRAIL
- PIPELINE
- POWERLINE
- BRIDGE
- BUILDING
- (64) STATE ROUTE

CURRENT LAND OWNERSHIP

- PRIVATE OWNED
- SUPERIOR OIL COMPANY (SURFACE & MINERAL ESTATES)
- BLM (SURFACE & MINERAL ESTATES)
- DIV. OF WILDLIFE (SURFACE ESTATES) SUPERIOR OIL (MINERAL ESTATES) UNLESS NOTED (EXCEPTED)

COMPONENTS OF THE PROPOSED LAND EXCHANGE

- LAND BLM WOULD RECEIVE, (SURFACE & MINERAL ESTATES, 2572 ACRES)
- LAND SUPERIOR OIL COMPANY WOULD RECEIVE, (SURFACE & MINERAL ESTATES, 2045 ACRES)
- LAND SUPERIOR WOULD PURCHASE FROM DIVISION OF WILDLIFE (SURFACE ONLY, 400 ACRES)

R.96 W.

T.2 N.

T.1 N.

RIVER
Gravel Pits
(64)
BR 5700
Gas Well
5700
DETAIL "A"
White River City (Site)
STATE
WHITE
FISHING
Rio Blanco Lake
AREA
(EXCEPTED)
BR5806
BM 5786
5800
5771
6
5
3
2
1
10
11
TRAIL
RIVER
Creek
WILDLIFE
OF
(EXCEPTED)
5900
6000
6400
6800
7021
6700
6600
6691
6665
6452
6410
6300
6200
6100
5982
5889
5758
5778
BR5741
BM 5778

White River City
(Site)

Rio Blanco Lake AREA
(EXCEPTED)

RIVER

TRAIL

Creek

WILDLIFE

DETAIL "B"

Piceance

Reinjection Wells

T. 1 N.

DETAIL "A"
PLANT SITE LAYOUT

R.97W.

Proposed Superior O
Oil Shale Developm

Map 2-1
General Soils & Vegetation

1000

N

United States
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Bureau of Land Management
Colorado State Office
Denver, Colorado

WHITE RIVER

COLORADO

DIVISION OF WILDLIFE

Gravel Pits

Gas Well

Yellow Creek

TRAIL

DEEP

PIPELINE

RT
BL
GP
X64
X62
X39
71C
77E
65E
60D
60C
33C
38
47
63
73
75
70
41
33
13
6
64

28 29 30 31 32 33
6 5 4 3 2 1
7 8 9 10 11

VEGETATION LEGEND

Mapping Symbol	Mapping Unit Name	Dominant Species	Associated Species
	Pinyon - Juniper	Pinyon Pine, Juniper	Indian ricegrass, scarlet globe mallow, hairy goldaster, fleabane, big sagebrush, serviceberry, mountain mahogany
	Chained Pinyon-Juniper	Indian Ricegrass	Sandberg bluegrass, squirreltail, bitter brush, mountain mahogany, serviceberry, rabbit brush, pinyon, juniper
	Sagebrush	Big Sagebrush	Indian ricegrass, sandberg bluegrass, cheatgrass, western wheatgrass, balsamroot, buckwheat, grasswood
	Grasswood	Grasswood	Western wheatgrass, basin wildrye, cheatgrass, desk, mustard, stickseed, sagebrush
	Cropland	Alfalfa, meadow grasses	
	River Bottom	Cottonwood, willow, salt cedar	Rush, sedge
	Barren	Saltgrass	Rush, sedge, dandelion, mustard

1. BLM, Parachute Planning Unit, Unit Resource Analysis, 1978.

Proposed Superior Oil Company Land Exchange & Oil Shale Development Environmental Statement

Map 2-1
General Soils & Vegetation

Scale = Feet

1000 2000 3000 4000 5000

United States
Department of the Interior
Bureau of Land Management
Colorado State Office
Denver, Colorado

-LEGEND-

- HEAVY DUTY ROAD
- MEDIUM DUTY ROAD
- UNIMPROVED DIRT ROAD
- TRAIL
- PIPELINE
- POWERLINE
- BRIDGE
- BUILDING
- (64) STATE ROUTE

R.97 W.

R.96 W.

T. 2 N.

T. 1 N.

WHITE RIVER

Gravel Pits

Gas Well

White River City (Site)

STATE FISHING AREA

Rio Blanco Lake

WILDLIFE

Creek

TRAIL

PIPELINE

Soils Legend

Stratums
Thickness and Texture

Mapping Symbol	Mapping Unit Name	Slope %	First Layer	Second Layer	Third Layer	Comments
6	Redrob Loam	1-3	4", loam	13", loam and sandy loam	gravelly and cobbly loamy sand	
9	Hagga Loam	0-5	9", loam	18", clay loam	1-12", clay loam and silty clay loam stratified with sandy loam	
13	Trembles Loam	0-3	3", loam	5-27", loam and sandy loam stratified with silty clay loam and sand	60+", stratified sandy loam and sand	
33	Tosworth Fine Sandy Loam	0-5	4", sandy loam and loam	7", clay loam	24", sandy loam, loam and clay loam	Alkaline soil. Rock fragments in third layer.
33C	Tosworth Fine Sandy Loam	5-12	See 33 above.			
38	Havre Loam	0-3	5-22", loam	14", stratified loam and silty clay loam	60+", stratified loam and sandy loam	Alkaline soil.
X39	Nihill channery Fine Sandy Loam	5-60	4", gravelly loam	7-17", gravelly loam	60+", loam, sandy loam and clay loam.	Alkaline soil.
41	Glendive Fine Sandy Loam	2-15	12", sandy loam	60+", stratified loams, sandy loam and gravelly loam		
47	Absor Clay Loam	5-30	4", clay loam	20", silty clay loam and silty clay	9", silty clay loam	Alkaline soil. Underlying clay shale bedrock.
50	Parent Loam	0-3	10", loam and silty loam	80+", stratified clay loam, silty loam and sandy loam		Alkaline soil.
50C	Parent Loam	3-9	See 50 above.			
50D	Parent Loam	9-15	See 50 above.			

White River City (Site)

FISHING AREA

Rio Blanco Lake

RIVER

T. 1 N.

Piceance Creek

WILDLIFE

JEEP TRAIL

PIPELINE

Road

Flat

Wash

TRAIL

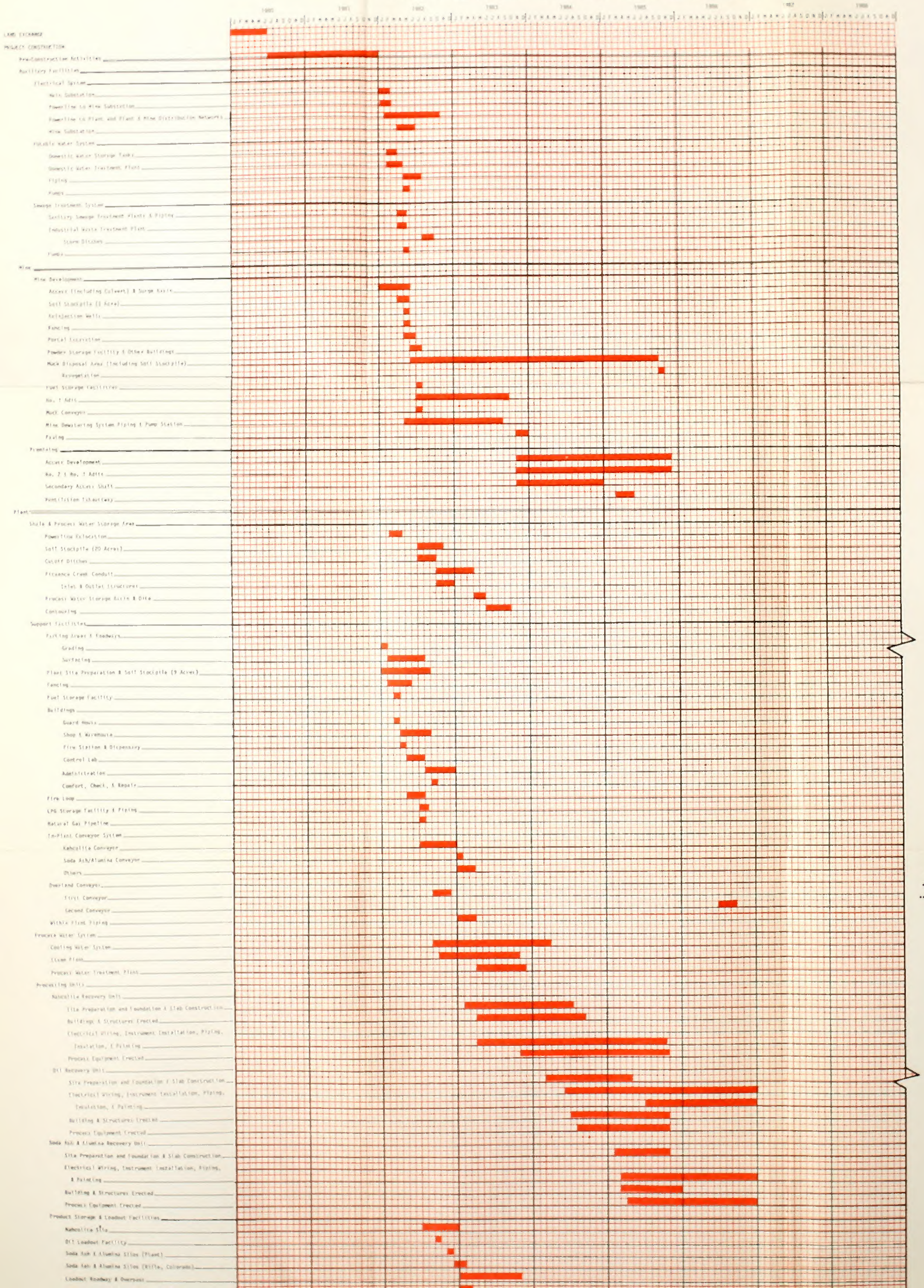
Soils Legend

Strata
Thickness and Texture

Mapping Symbol	Mapping Unit Name	Slope %	First Layer	Second Layer	Third Layer	Comments
6	Redrob Loam	1-3	4", loam	13", loam and sandy loam	gravelly and cobbly loamy sand	
9	Haggs Loam	0-5	9", loam	18", clay loam	1-12", clay loam and silty clay loam stratified with sandy loam	
13	Trembles Loam	0-3	3", loam	5-27", loam and sandy loam stratified with silty clay loam and sand	60+", stratified sandy loam and sand	
33	Tisworth Fine Sandy Loam	0-5	4", sandy loam and loam	7", clay loam	24", sandy loam, loam and clay loam	Alkaline soil. Rock fragments in third layer.
33C	Tisworth Fine Sandy Loam	5-12	See 33 above.			
38	Havre Loam	0-3	5-22", loam	14", stratified loam and silty clay loam	60+", stratified loam and sandy loam	Alkaline soil.
X39	Nihill channery Fine Sandy Loam	5-50	4", gravelly loam	7-17", gravelly loam	60+", loam, sandy loam and clay loam.	Alkaline soil.
41	Glendive Fine Sandy Loam	2-15	12", sandy loam	60+", stratified loams, sandy loam and gravelly loam		
47	Abor Clay Loam	5-30	4", clay loam	20", silty clay loam and silty clay	9", silty clay loam	Alkaline soil. Underlying clay shale bedrock.
50	Patent Loam	0-3	10", loam and silty loam	60+", stratified clay loam, silty loam and sandy loam		Alkaline soil.
50C	Patent Loam	3-8	See 50 above.			
50D	Patent Loam	8-15	See 50 above.			
X62	Calciorthids - Tridell Complex	6-50	2-5", gravelly, cobbly loam, clay loam and sandy loam	30+", gravelly, cobbly loam and sandy loam		Alkaline soil.
63	Remsac Channery Sandy Loam	5-50	9", gravelly sandy loam	7", sandy loam		Underlying fractured hard sandstone.
X64	Blazon - Remsac Complex	8-65	4", gravelly loam	7", gravelly clay loam	gravelly silty clay loam	Alkaline soil. Underlying weathering shale.
65E	Meyerson Very Stony Clay Loam	15-65	2", gravelly loam	15", clay loam and clay		Underlying highly fractured shale.
70	Piceance Fine Sandy loam	5-15	4", sandy loam	18", sandy loam and loam	18", gravelly sandy loam	Alkaline soil. Underlying hard sandstone.
71C	Forelle Loam	3-8	4", loam	15", clay loam and loam	60+", loam	Alkaline soil.
73	Yamac Loam	5-15	4", loam	31", clay loam and loam	60+", loam and sandy loam	
75	Rivra Channery Loamy Sand	2-9	6", gravelly loamy sand	37-60", gravelly sand and gravelly loamy sand		Alkaline soil.
77E	Dollard Silty Clay Loam	15-50	3-8", silty clay loam	28", clay loam		Underlying calcareous weathered shale.
X89	Bluewing - Cragola Variant Complex	8-65	8", gravelly loam	21", gravelly sandy loam	60+", stratified gravelly, cobbly sandy loam and sand	Alkaline soil.
BL	Badland		Rolling to steep slopes, low hills, ridge tops and canyon walls. Soils are generally very shallow, some being moderately deep. Almost completely barren with very sparse vegetation.			Highly erodible.
GP	Gravel Pit		Active or old areas where gravel mining has been or is occurring.			
RT	Rock Outcrop	15-90	Occurring mainly as vertical sandstone, shale cliffs or uplifted, tilted dike-like outcrops. May include some very shallow to moderately deep soils occurring on lower slopes.			

Reference: Rio Blanco Soil Survey, (unpublished). Soil Conservation Service, Meeker, Colorado.

FIGURE 1-2 ASSUMED SCHEDULE FOR THE PROPOSED SUPERIOR OIL PROJECT



* Would begin operating once construction is completed.

** Production rate of about 3,350 tons per day (during initial phasing).

*** Initial 6 months would be a start-up, or adjustment, period (fueled by LPG gas).

- Mine Dewatering System Piping & Pump Station
- Portal
- Prestripping
- Access Development
- No. 2 & No. 3 Adits
- Secondary Access Shaft
- Ventilation Exhaustway
- Plant
- Shale & Process Water Storage Area
- Properties Relocation
- Soil Stockpile (20 Acres)
- Cutoff Ditches
- Diversion Stream Conduit
- Inlet & Outlet Structures
- Process Water Storage Basin & Dike
- Landscaping
- Support Facilities
- Parking Areas & Roadways
- Grading
- Surfacing
- Plant Site Preparation & Soil Stockpile (9 Acres)
- Fencing
- Fuel Storage Facility
- Buildings
- Guard House
- Shop & Warehouse
- Fire Station & Dispensary
- Control Lab
- Administrative
- Comfort, Check, & Repair
- Fire Loop
- LPG Storage Facility & Piping
- Natural Gas Pipeline
- Trailer Conveyor System
- Kerogen Conveyor
- Soda Ash/Alumina Conveyor
- Others
- Overland Conveyor
- First Conveyor
- Second Conveyor
- Waste Plant Piping
- Process Water System
- Cooling Water System
- Steam Plant
- Process Water Treatment Plant
- Processing Units
- Kerogen Recovery Unit
- Site Preparation and Foundation & Slab Construction
- Buildings & Structures Erected
- Electrical wiring, Instrument Installation, Piping, Insulation, & Painting
- Process Equipment Erected
- Oil Recovery Unit
- Site Preparation and Foundation & Slab Construction
- Electrical wiring, Instrument Installation, Piping, Insulation, & Painting
- Buildings & Structures Erected
- Process Equipment Erected
- Soda Ash & Alumina Recovery Unit
- Site Preparation and Foundation & Slab Construction
- Electrical Wiring, Instrument Installation, Piping, & Painting
- Buildings & Structures Erected
- Process Equipment Erected
- Product Storage & Loadout Facilities
- Kerogen Silo
- Oil Loadout Facility
- Soda Ash & Alumina Silos (Rifle)
- Soda Ash & Alumina Silos (Cliffe, Colorado)
- Loadout Roadway & Overpass
- Oil Storage Tanks

PROJECT OPERATION

- Auxiliary Facilities
- Electrical System
- Potable Water System
- Water Source - White River
- Water Source - Soda Ash & Alumina Units
- Sewage Treatment System
- Effluent Hauled to Meeker, Colorado
- Effluent Piped to the Process Water Storage Basin
- Mine
- Initial Mining
- Full Scale Mining
- Plant
- Shale & Process Water Storage Basin
- Shale Storage Area
- Process Water Storage Basin
- Process Water System
- Processing Units
- Kerogen Recovery Unit
- Initial Production **
- Full Scale Operation
- Oil Recovery Unit ***
- Soda Ash & Alumina Processing Units
- Backfilling
- Facility Installation
- Operation

ABANDONMENT

- Mine
- Reinjection Wells & Secondary Access Shaft
- Portal Facilities
- Plant
- Shale & Process Water Storage Area
- Electrical Distribution System
- Plant Site
- Overland Conveyor

1980 1981 1982 1983 1984 1985 1986 1987 1988

2006 2007 2008

* Would begin operating once construction is completed.

** Production rate of about 3,350 tons per day (during initial mining).

*** Initial 6 months would be a start-up, or adjustment, period (fueled by LPG gas).

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